Vol. 15, No. 1
January 15, 1990

Energy Research Abstracts

Abstracts 1–2012

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

The Office of Scientific and Technical Information

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

International Copyright, © U.S. Department of Energy, 1990, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 15, No. 1
January 15, 1990
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

- Canada
- Denmark
- Finland
- France
- Federal Republic of Germany
- Italy
- Japan
- The Netherlands
- Norway
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

How To Read A Citation

The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

1849 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas. Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 Polarization of fast particle beams by collisional pumping. Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

TO OBTAIN NON-REPORT LITERATURE

Nonreport literature generally is available from the commercial publisher or corporation listed in the citation. These documents may also be available for loan from local libraries. First, check with the local library. Other sources of information are:

Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

Foreign material The Linda Hall Library is an excellent source of foreign materials. For translations of foreign language material, contact the Library of Congress National Translation Center. For material difficult to locate, check with the British Library Document Supply Centre.

On-Line Computer Library Center
6565 Frantz Road
Dublin, OH 43107-0702
614-764-6000

Library of Congress
National Translation Center
Washington, D.C. 20540
202-707-0100

Linda Hall Library
5109 Cherry Street
Kansas City, MO 64110
816-363-4600

British Library Document Supply Centre
Boston Spa, Weatherby
West Yorkshire
LS23 7BQ
United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
15:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 40 first-level and the 289 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

Numerical Listing of Categories

01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

05 Economic and Financial Aspects
06 Environmental Aspects and Waste Disposal
07 By-Products
08 Geothermal Power Plants
09 Geothermal Engineering
10 Direct Energy Utilization
20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
03 Regulations
04 Economics
05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
03 Regulations
04 Economics
05 Environmental Aspects
06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
01 Power Plants and Power Generation
02 Environmental Control Technology
03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

25 ENERGY STORAGE
01 Magnetic
02 Compressed Gas
03 Pumped Hydro
04 Capacitor Banks
05 Flywheels
06 Thermal
07 Liquefied Gas
08 Chemical
09 Batteries

29 ENERGY PLANNING AND POLICY
01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Natural Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Waste Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
01 Buildings
02 Transportation
03 Industry and Agriculture
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

35 ARMS CONTROL
01 Policy, Negotiations, and Legislation
02 Proliferation
03 Verification

36 MATERIALS
01 Metals and Alloys
02 Ceramics, Cermets, and Refractories
06 Other Materials

40 CHEMISTRY
01 Analytical and Separations Chemistry
02 Inorganic, Organic, and Physical Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
02 Facilities and Equipment
03 Lasers
04 Heat Transfer and Fluid Flow
05 Materials Testing
08 Electronic Circuits and Devices
09 Waste Processing Plants and Equipment
10 Combustion Systems
20 Underground Engineering
30 Marine Engineering
40 Pollution Control Equipment
50 Power Cycles

43 PARTICLE ACCELERATORS
01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION
01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
03 Miscellaneous Instruments
04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
01 Chemical
02 Nuclear
03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 05 Metabolism
- 06 Medicine
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health
- 30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 01 Radiation Effects
- 02 Thermal Effects
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 04 Geochemistry
- 05 Oceanography

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 10 Nuclear Physics
- 12-20 Nuclear Properties and Reactions
- 30 Nuclear Theory
- 40 Radiation and Shielding Physics
- 50 Medical Physics
- 60 Condensed Matter Physics
- 61 Superconductivity
- 70 Theoretical and Mathematical Physics

70 FUSION ENERGY
- 01 Plasma Research
- 02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
- 01 Management
- 02 Mathematics and Computers
- 03 Information Handling
- 04 Law
- 05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

Alphabetical Listing of Categories

33	ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
35	ARMS CONTROL
56	BIOMEDICAL SCIENCES, APPLIED STUDIES
55	BIOMEDICAL SCIENCES, BASIC STUDIES
40	CHEMISTRY
01	COAL AND COAL PRODUCTS
30	DIRECT ENERGY CONVERSION
20	ELECTRIC POWER ENGINEERING
32	ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
29	ENERGY PLANNING AND POLICY
25	ENERGY STORAGE
42	ENGINEERING
52	ENVIRONMENTAL SCIENCES, AQUATIC
50	ENVIRONMENTAL SCIENCES, ATMOSPHERIC
51	ENVIRONMENTAL SCIENCES, TERRESTRIAL
53	ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
45	EXPLOSIONS AND EXPLOSIVES
70	FUSION ENERGY
99	GENERAL AND MISCELLANEOUS
58	GEOSCIENCES
15	GEOTHERMAL ENERGY
57	HEALTH AND SAFETY
13	HYDRO ENERGY
08	HYDROGEN
44	INSTRUMENTATION
07	ISOTOPE AND RADIATION SOURCE TECHNOLOGY
36	MATERIALS
03	NATURAL GAS
05	NUCLEAR FUELS
21	NUCLEAR POWER PLANTS
22	NUCLEAR REACTOR TECHNOLOGY
04	OIL SHALES AND TAR SANDS
09	OTHER SYNTHETIC AND NATURAL FUELS
43	PARTICLE ACCELERATORS
02	PETROLEUM
64	PHYSICS I
65	PHYSICS II
14	SOLAR ENERGY
16	TIDAL AND WAVE POWER
17	WIND ENERGY

Energy Research Abstracts

01 COAL AND COAL PRODUCTS

0103 Preparation

Refer also to citation(s) 26, 310

1 **Clean Coal Technology Program. Hearings before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, April 2 and 9, 1987.** S. Hrg. 100-388. 339p. Government Printing Office, Washington, DC (US) (1988).

This set of two hearings discussed the status of the Clean Coal Technology Program which was established to promote the use of coal in an environmentally sound manner. Witnesses discussed the technologies, their commercialization, and constraints to commercialization. The technologies discussed were coal cleaning and upgrading; wet flue gas desulfurization; dry sulfur dioxide control; nitrogen oxides control by combustion and reburning and by post-combustion; atmospheric and pressurized fluidized bed combustion; and integrated gasification combined cycle power generation. Testimony was heard from 14 witnesses, representatives of Electric Power Research Institute, American Electric Power Service Corp, Kentucky Energy Cabinet, Edison Electric Institute, National Coal Association, Department of Energy, Gas Research Institute, and representatives from West Virginia, Kentucky, Louisiana, Nevada, and Idaho.

0104 Processing

Refer also to citation(s) 1, 24, 26, 31, 827

2 (AD-A-209773/1/XAB) **Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989.** Furlong, M.W.; Fox, J.D.; Masin, J.G. Amoco Oil Co., Naperville, IL (USA). Research and Development Dept. Jun 1989. 71p. Available from NTIS, PC A04/MF A01.

See also Volume 1, AD-A184 846.

Amoco Oil Company has conducted bench- and pilot plant-scale experiments to produce jet fuels from the tar oil from the Great Plains Coal Gasification Plant in Beulah, North Dakota. Experiments show that the hydroprocessing conditions recommended in Task I are not severe enough to saturate the aromatics in the tar oil to meet jet-fuel specifications. Alternatives were investigated. Jet-fuel specifications can be achieved when the tar oil is: hydrotreated in an expanded-bed hydrotreater to lower aromatics and heteroatom content; the effluent is then hydrotreated in a second, fixed-bed hydrotreater; and, finally, the 550 F boiling fraction from the two hydrotreaters is hydrocracked to extinction. The process was verified by pilot-plant production of 2 barrels of JP-8 turbine fuel, which met all but the flash-point specification for JP-8.

3 (AD-A-210074/1/XAB) **Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988.** Johnson, R.W.; Zackro, W.C.; Czajkowski, G.; Shah, P.P.; Kelly, A.P. Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center. Mar 1989. 131p. Available from NTIS, PC A07/MF A01.

The U.S. Air Force has an ongoing program to evaluate various endothermic fuels for cooling aircraft structures. The fuels will provide a heat sink by vaporization (latent heat) and endothermic reactions (dehydrogenation) before use as fuel in aircraft engines. Cycloparaffins hold the most promise for use as endothermic fuels. The U.S. Air Force is also evaluating various feedstock sources of endothermic fuels. The technical feasibility of producing endothermic fuel from the naphtha by-product from the Great Plains Gasification Plant in Beulah, North Dakota was evaluated. The capital and operating costs of deriving the fuel from coal naphtha were also estimated. The coal naphtha from Great Plains was successfully processed to remove sulfur, nitrogen and oxygen contaminants (UOP HD UNIBON Hydrotreating) and then to saturate aromatic molecules (UOP AH UNIBON). The AH UNIBON product was fractionated to yield endothermic fuel candidates with less than 5% aromatics. The major cycloparaffins in the AH UNIBON product were cyclohexane and methylcyclohexane. The production on endothermic fuel from the naphtha by-product stream was estimated to be cost competitive with existing technology. (AW)

4 (DOE/MC/23288-2742) **Steam conditioning of coal for synfuels production: Second quarterly report, April 1-June 30, 1987.** Graff, R.A.; Zhou, Peizheng; Brandes, S.D. City Coll., New York, NY (USA). 1987. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC23288. Order Number DE90001105. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Conditioning of coal in steam is being explored for the purpose of improving the yield and quality of condensable product obtainable in the mild gasification of coal. Steam conditioning of Illinois No. 6 coal has been tested at pressures from 50 to 1 atmosphere. The strength of the conditioning effect, as measured by extraction with pyridine, decreases gradually with decreasing pressure. It ceases to be of importance at a pressure between 30 and 1 atmosphere. Modifications to the semicontinuous pyrolysis reactor for operation to 50 atmospheres were completed. Thirty-nine runs were conducted on raw and conditioned Illinois No. 6 coal at 500 psia; fifteen runs were conducted on raw coal at 750 psia. 2 refs., 10 figs., 7 tabs.

5 (DOE/PC/71257-T18) **Novel experimental studies for coal liquefaction: Final report.** Holder, G.D.; Tierney, J.W. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. 15 Jun 1989. 123p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-84PC71257. Order Number DE90000642. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Two studies related to coal liquefaction were carried out. The major effort in study was to investigate experimentally a novel reaction sequence for conversion of synthesis gas to methanol. The reaction studied in this work takes place in the liquid phase and consists of two reactions occurring in series. In the first, methanol is carbonylated to methyl formate using a homogeneous catalyst and then the formate is hydrogenated to two molecules of methanol using a heterogeneous catalyst. The reactions were studied individually and then concurrently (both reactions taking place in the same slurry reactor). A modeling study of the non-isothermal unsteady state Fischer-Tropsch reaction was carried out. In the second study the use of supercritical water for extraction and conversion of coal and oil shale was investigated. The two primary goals were to study the kinetics and mass transfer differences between conventional and supercritical liquefaction. The kinetic effects were studied by liquefying coal in supercritical toluene. Mass transfer studies were carried out on a model system consisting of naphthalene and supercritical carbon dioxide. 64 refs.

6 (DOE/PC/90533-9) **Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988-December 15, 1988.** Bartholomew, C.H. Brigham Young Univ., Provo, UT (USA). 23 Oct 1989. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90533. Order Number DE90002247. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the ninth quarter, progress was made toward completion of a system manual for the automated Berty reactor system; system testing was also initiated. More accurate molar response factors and retention time data were developed from calibration gases for chromatographic analysis of products during activity/selectivity runs. CO hydrogenation activity/selectivity tests were conducted on a new alumina-promoted iron catalyst Fe-A-201 at a H_2/CO ratio of 3 in the temperature range of 200-230°C over a period of 150 hours.

The specific activity of this catalyst was the same within experimental error as previously tested unsupported, unpromoted iron catalysts; however, this new alumina-promoted catalyst was found to have greater thermal stability against sintering upon rereduction in hydrogen. Long term tests are consistent with loss of specific activity and an increase in methane selectivity due to carbon deposition after reaction at 230°C. 48 refs., 8 figs., 3 tabs.

7 (EGG-M–89235) **Genetic manipulation of acidophilic bacteria.** Ward, T.E.; Rowland, M.L.; Glenn, A.W.; Watkins, C.S.; Bruhn, D.F.; Bulmer, D.; Roberto, F.F. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-890916–3: 6. annual international Pittsburgh coal conference, Pittsburgh, PA (USA), 25-29 Sep 1989). Order Number DE90002048. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thiobacillus ferrooxidans is important in leaching of metals from mineral ores and in the removal of pyritic sulfur from coal. It is also intimately involved in production of acid mine drainage. Other acidophilic bacteria, including members of the genus Acidiphilium, are usually present in the same environments as T. ferrooxidans, and there is evidence to suggest that these acidophilic heterotrophs may increase the rate of T. ferrooxidans' attack on inorganic sulfides. Our laboratory is studying the genetic characteristics of these acidophilic bacteria and developing techniques for introducing desirable genes into them. Several endogenous plasmids from Acidiphilium strains have been cloned into E. coli vectors. Some of the resulting plasmids are able to confer antibiotic resistance to Acidiphilium after transformation by electroporation. In addition, a broad-host range plasmid conferring resistance to tetracycline has been introduced into Acidiphilium strains by electroporation. This same plasmid, has also been transferred to Acidiphilium from E. coli directly by conjugation. A temperate bacteriophage which infects a number of Acidiphilium isolates has been discovered and partially characterized. It has a lambdoid morphology and a genome of approximately 97 kb, comprised of double-stranded DNA which is probably modified. 16 refs., 2 figs., 4 tabs.

8 (EGG-M–89237) **Approaches to cleaning and conversion of coal through bioprocessing.** Dugan, P.R.; McIlwain, M.E.; Quigley, D.; Stoner, D.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 5p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-890916–4: 6. annual international Pittsburgh coal conference, Pittsburgh, PA (USA), 25-29 Sep 1989). Order Number DE90002035. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Bioprocessing of raw feedstocks, such as coal, is an emerging technology. Although the use of microorganisms to produce alcohol, food stuffs, drugs, enzymes, and decomposition of wastes has been employed for many years, the concept of using microorganisms to produce materials from naturally occurring resources such as coal, is relatively new. The use of microorganism-promoted extraction of minerals is the oldest process and has been recognized for about forty years. Today, approximately 25% of the world's copper production is derived using microbial leaching of low grade deposits and tailings. The use of microorganisms to process coal can be traced back to studies in the early 1950's where researchers were investigating the actions of microbes on coal. Today, there is research on bioprocessing of coals in four areas: desulfurization, deashing, solubilization, and conversion of coal derived materials. As yet, there has not been any demonstrated upscaled technology related to the use of microorganisms to process coals other than the use of microbes to assist in agglomeration processes. However, a number of processes have been proposed to remove sulfur and ash from high sulfur coals and to produce methane from low rank coals. 36 refs.

9 (EPRI-GS–6493) **Virginia Power's study of a Shell-based GCC [gasification combined-cycle] power plant: Final report.** Combs, R.T.; Leaf, D.T.; Verno, G.A. Electric Power Research Inst., Palo Alto, CA (USA); Virginia Electric and Power Co., Glen Allen, VA (USA). c Sep 1989. 363p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This study developed design, performance, and cost information for a three-phase nominal 420 MWe Shell-based gasification combined-cycle (GCC) power plant located at Virginia Power's Chesterfield Power Station. Phases 1 and 2 consist of two identical natural gas- or distillate-fired combined-cycle units, each producing a nominal 210 MWe. Phase 3 consists of adding the coal gasification facilities. The gasification plant uses a Central Appalachian coal and is sized to fully load the two General Electric MS7001F combustion turbines at 90°F ambient temperature. Sensitivity studies examined the impacts of alternate coals, liquid oxygen storage, preinvestment and NO_x emission limits. The study results indicate that at 90°F, the Phase 3 GCC power plant has a heat rate on coal of 8968 Btu/kWh and a total capital requirement of $1516/kW. Total capital requirements for the initial combined-cycle phases ranged from approximately $595/kW for Phase 1 to $570/kW for Phase 2. Sensitivity studies showed only modest cost and performance impacts for designing the gasification plant to either handle a range of coal properties, or to meet more restrictive NO_x emission limits. The performance and cost information was then used by Virginia Power to perform an economic assessment consisting of production costs, revenue requirements, and other financial results.

10 (ORNL/FTR–2908) **[Materials for hot gas cleanup in coal conversion and utilization systems]: Foreign trip report, May 31, 1988–June 16, 1988.** Judkins, R.R. Oak Ridge National Lab., TN (USA). 22 Jun 1988. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90001741. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purposes of this trip were to learn about English government-funded and Dutch privately-funded research on materials for hot-gas cleanup in coal conversion and utilization systems, to present a paper on the Advanced Research and Technology Development Fossil Energy Materials Program at the 33rd ASME International Gas Turbine and Aeroengine Congress and Exposition (ASME Congress), and to serve as vice-chairman of a technical session on turbomachinery erosion. Visits were made to the British Coal Corporation Coal Research Establishment (CRE) and the University of Surrey in England and to Shell International Petroleum Maatschappij in The Netherlands. A project was identified for CRE and the University of Surrey to test Oak Ridge National Laboratory (ORNL)-produced fiber-reinforced ceramic filter specimens. Materials research areas of mutual interest to Shell and ORNL were identified. Many fruitful discussions were held at the ASME Congress, and the paper that was presented was well received.

11 (PB–89-160873/XAB) **Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987.** Cool Water Coal Gasification Program, Daggett, CA (USA). 25 Mar 1988. 91p. Available from NTIS, PC A05/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-88-218-049-45. See also PB–89-160915. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. The program agreed to comply with existing environmental monitoring in the areas of water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1984-1989. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. Monitoring data are to provide an information base for evaluating plant operations and for establishing information on environmental uncertainties associated with replication of synthetic-fuels facilities. The report describes monitoring and analysis of eleven operational runs (2,294 hours) during the quarter, including use of the quench gasifier and the main gasifier.

12 (PB–89-860837/XAB) **Centrifuges: fuel technology applications. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 105p. Available from NTISPC N01/MF N01.

See also PB–89-860845 and PB–89-860852.

This bibliography contains citations concerning the applications of centrifugation to fuels. Topics include the separation and cleaning of coal and other fuel materials, pumping of slurries, combustion modeling, modeling of waste fuel solids, fracture and creep modeling of oil and gas wells, and ground subsidence near fuel sources. Applications of centrifuges to uranium fuels are excluded. Applications of centrifuges to uranium fuel, civil engineering and geotechnology are discussed in separate bibliographies. (Contains 168 citations fully indexed and including a title list.)

13 **Great Plains coal gasification project. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session, September 12, 1988.** S. Hrg. 100-935. 117p. Government Printing Office, Washington, DC (US) (1989).

The hearing was called to review the announcement by the Department of Energy that it has selected Basin Electric Power Cooperative of Bismarck, North Dakota, as the preferred buyer for the Great Plains Coal Gasification Plant. The plant produces 142 billion standard cubic feet of synthetic natural gas per day from lignite coal plus several byproducts which are marketed. The hearing examines the bids of the finalists, the composition of the trust funds, the status of the siting permits, questions of air quality, employee retirement funds and employee benefits, and the ability of the successful bidder to pursue byproduct development and marketing. Testimony was heard from 7 witnesses.

14 **Fluidized-bed bioreactor process for the microbial solubilization of coal.** Scott, C.D.; Strandberg, G.W. To Dept. of Energy, Washington, DC. USA Patent 4,846,964. 11 Jul 1989. Filed date 14 Sep 1987. Int. Cl. C10G 1/00. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a fluidized-bed bioreactor system for the conversion of coal into microbially solubilized coal products. The fluidized-bed bioreactor continuously or periodically receives coal and bio-reactants and provides for the production of microbially solubilized coal products in an economical and efficient manner. An oxidation pretreatment process for rendering coal uniformly and more readily susceptible to microbial solubilization may be employed with the fluidized-bed bioreactor.

15 **Method of inducing surface ensembles on a metal catalyst.** Miller, S.S. To Dept. of Energy, Washington, DC. USA Patent 4,840,931. 20 Jun 1989. Filed date 2 Oct 1987. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method of inducing surface ensembles on a transition metal catalyst used in the conversion of a reactant gas or gas mixture, such as carbon monoxide and hydrogen into hydrocarbons (the Fischer-Tropsch reaction) is disclosed which comprises adding a Lewis base to the syngas ($CO+H_2$) mixture before reaction takes place. The formation of surface ensembles in this manner restricts the number and types of reaction pathways which will be utilized, thus greatly narrowing the product distribution and maximizing the efficiency of the Fischer-Tropsch reaction. Similarly, amines may also be produced by the conversion of reactant gas or gases, such as nitrogen, hydrogen, or hydrocarbon constituents.

0105 By-products

Refer also to citation(s) 2, 3

16 (VTT-TUTK–582) **Use of peat in wood adhesives.** Kilpelaeinen, H.; Lappi, M.; Wilen, C.; Thun, R. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Feb 1989. 98p. (In Finnish). Order Number DE89787767. Available from NTIS (US Sales Only), PC A05/MF A01.

In the first part of this research the composition, properties, the present utilization of peat as well as the possibilities for peat's utilization in wood adhesives were investigated on the basis of literature. The possibilities for the utilization of peat in adhesives are: the use of peat powder and the use of peat extracts; in this case the most reactive polyphenolic components are extracted from the peat. In the case of using peat powder in plywood adhesives, the quality requirements, production technology and costs of peat powder were investigated. Gluing experiments were carried out both in the laboatory and in one plywood mill. On the basis of the results, we can say that peat powder made from decomposed milled peat can substitute partially or totally for today's powder hardeners, extenders and fillers, like quebracho-extract, wheat flour wheat flour and wood dust. From peat extracts, the composition, amount and the extraction methods of the phenolic matters (lignin and humic substances) of peat were investigated on the basis of literature and extraction experiments were made. The extraction yields were 15-64% depending on the kind of peat and extraction conditions, the highest values being from strongly humified sedge peats. The reactivity of extracts were measured by using the formaldehyde up-take method. The differences in the reactivities between the different peat samples obtained under various extraction conditions were no systematic, though on average the most reactive extract originated from medium humified sedge peat. In gluing experiments a sufficient quality of glue-line was achieved by substituting part of the phenolic resin (11 weight parts) in plywood glue and half of resorcinol-phenolic resin in glue-lam glue for peat extract.

0106 Properties

Refer also to citation(s) 33

17 (CONF-890902–17) **Identification of the heteroatom containing compounds in the benzene/methanol extracts of the Argonne Premium Coal Samples.** Neill, P.H.; Xia, Yun ju; Winans, R.E. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep 1989. Order Number DE90001766. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Argonne Premium Coal Samples (APCS) provide a unique opportunity to study a set of pristine samples specifically selected to represent the vast diversity of chemical structures exhibited by US coals. The purpose of this paper is to utilize high resolution mass spectrometry (HRMS) to characterize the heteroatom containing species that can be extracted from the APCS. Of special interest is the change in structure and relative concentrations that these compounds undergo with rank. The resulting information is important in providing basic chemical structural information concerning these coals which are being used by a significant portion of the coal community, and understanding the transformations that the heteroatom containing species undergo during the coalification process. 15 refs., 4 figs., 2 tabs.

18 (CONF-890902–18) **Analysis and comparison of two Victorian Brown Coal resinite samples.** Anderson, K.B.; Botto, R.E.; Dyrkacz, G.R.; Hayatsu, R.; Winans, R.E. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep 1989. Order Number DE90001983. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Among the organic constituents of coal, the maceral resinite is probably the least complex structurally, due to the relatively simple composition of the original resins. Hence, with careful analysis, it may be possible to construct meaningful and accurate structural descriptions of this maceral. For the purposes of this study, two physically diverse resinite samples were obtained from Victorian Brown Coal (VBC) by hand picking from open cut mine faces. The first sample, which is referred to as "resinite" throughout this text is a hard, brittle, glassy material, yellow/brown in color. The second is a soft, brittle, bone white material, which was found in association with a large gymnosperm log, of undetermined paleobotanical affinity, as sheets between "wood" and "bark." This material is sometimes referred to as "bombicite" by geologists, and is referred to by this name in this text in the interests of clarity. Petrographically, both samples are classified as resinite. Pyrolysis-high resolution mass spectra were recorded on a Kratos MS-50 mass spectrometer. FTIR spectra were recorded on a Bruker 113 V FTIR spectrometer. CP/MAS ^{13}C NMR spectra were recorded on a Bruker CPX-100 NMR spectrometer. 7 refs., 3 figs., 1 tab.

19 (CONF-891001–8) **Chemical structures in eight US premium coals: The nature of the heteroatoms.** Winans, R.E.; Neill, P.H.; Hayatsu, R.; Botto, R.E. Argonne National Lab., IL

(USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on coal science; Tokyo (Japan); 23-27 Oct 1989. Order Number DE90001913. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this study is to elucidate the nature of the heteroatoms, sulfur, nitrogen and oxygen in coals. The heteroatoms play important roles in determining coal reactivity and the quality of coal conversion products. In this study, the eight coals from the Argonne Premium Coal Sample program ranging in rank from a lignite to low-volatile bituminous are examined. Several approaches are used to break down the macromolecular structure, including vacuum pyrolysis and several mild oxidative reactions. In addition, the extracts from these coals are characterized and the results compared to the data obtained from the macromolecule degradation. We have developed a direct pyrolysis, very-high resolution MS method combined with the use of a unique internal standard that cleanly pyrolyses at the same temperature as coal. This method is very useful for characterizing heteroatom containing species in the products semi-quantitatively. 9 refs., 3 figs., 1 tab.

20 (DOE/FC/10628–2712-Vol.1) **Oxidation and explosive limits of low-rank coal, Volume 1: Final report.** Kramer, S.K.; Cannon, J.N.; Smoot, L.D. Brigham Young Univ., Provo, UT (USA). Combustion Lab. Oct 1988. 66p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-85FC10628. Order Number DE89000997. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The principal objective of this study was to determine oxidation rates, flammability (explosive) limits and flame propagation rates of finely divided, low-rank, subbituminous coal from the Decker, Montana mine and to relate these data to the physical and chemical properties of the coal. The four basic tasks of the study were: (1) coal collection and preparation, (2) coal characterization, (3) rapid oxidation and flammability measurements, and (4) data reduction and reporting, 101 refs., 26 figs., 10 tabs.

21 (EGG-M–89181) **Chemical comminution and deashing of low rank coals.** Quigley, D.R.; Wiebe, S.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 3p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-890916–5: 6. annual international Pittsburgh coal conference, Pittsburgh, PA (USA), 25-29 Sep 1989). Order Number DE90002072. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Low rank coals were found to be soluble in dilute NaOH solutions. Solubilities of coals were highest in coals containing >20% oxygen. Solubilized coals could easily be separated from insoluble mineral inclusions and recovered by the addition of calcium at concentrations greater than 10mM. The potential use of this treatment for coal processing is discussed. 4 refs., 3 figs., 3 tabs.

22 **Acoustical and dielectric loss in natural macromolecular solids.** Weller, M. (Max Planck Institut fur Metallforschung, Stuttgart (West Germany)); Wert, C. pp. 4 of 1987 international conference on coal science. Moulijn, J.A.; Nater, K.A.; Chermin, H.A.G. (eds.) Elsevier Science Publishers B.V., Amsterdam, Netherlands (1987). DOE Contract AC02-76ER01198. (CONF-871030–: International conference on coal science, Maastricht (Netherlands), 26-30 Oct 1987).

All natural macromolecular solids have a spectrum of energy loss both of acoustical and dielectric origin. The acoustical loss arises from a time-dependent anelastic strain which lags the imposed stress by a phase angle. The dielectric loss arises from the polarization being out of phase with the imposed electric field. In metals and ceramic solids they are used to elucidate features of defects. For synthetic polymers, they are used to describe units of the macromolecular structure. Loss phenomena of acoustical and dielectric origin also exist in natural macromolecular materials: coal, wood, amber, cork and oil shale. The authors discuss the current status of the investigations here. They also show how differences in the loss spectra reflect differences in the structure of these solids.

23 **Depolymerization of a model coal polymer.** Lee, I. (Univ. of Oklahoma, Norman (USA)); Sliepcevich, C.M.; Mallinson, R.G. *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry (USA),* 32(4): 39-45 (1987). (CONF-870802–: 194. American Chemical Society national meeting, New Orleans, LA (USA), 30 Aug - 4 sep 1987).

In summary, the goal of this work is to develop a synthetic macromolecular network which may be used as a model for coal networks, and to take advantage of the high degree of characterization available such that the network may be thermally degraded and insights into the degradation of the networks in coal may be gained. Also, with the increased use of thermosetting polymer networks for materials applications, this knowledge is applicable to the understanding of thermal (or random) degradation and stability of these systems. This experimental work is being conducted in parallel with a modeling effort for the degradation of polymer networks.

0108 Waste Management

Refer also to citation(s) 1, 26, 29, 30, 310

24 (CONF-891046–2) **The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization.** Boparai, A.; Schneider, J.F.; Erickson, M.D.; Rahaelian, L. Argonne National Lab., IL (USA). 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Advanced research and technology development; Morgantown, WV (USA); 3-5 Oct 1989. Order Number DE90001929. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The main objectives of this project are: (1) apply advanced instrumentation, GC/MI-IR, supercritical fluid extraction (SFE), and SFC, for characterization of organic compounds present in coal waste products; (2) optimize conditions for SFE of coal and coal waste samples. The data from these techniques and from analysis by gas chromatography/mass spectrometry (GC/MS) is expected to aid in the identification of isomeric and high molecular weight compounds found in coal waste materials. Wastes produced by processing of coal and other fossil fuels are generally treated, chemically or biologically, before disposal. A knowledge of the chemical composition of wastes generated from these processes is required to aid in the design of innovative techniques for obtaining material suitable for safe and economical disposal. In order to characterize compounds, which could not be identified using GC/MS alone, we have applied SFE, SFC, and GC/MI-IR. GC/MI-IR was used for identifying several isomers and SFC was used to fractionate complex mixtures. More recently, we have employed SFE for directly coupled extraction of a coal sample followed by capillary SFC analysis.

25 (PB–89-221311/XAB) **Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process.** Finkel, J.M.; James, R.H.; Baughman, K.W.; Pau, J.C.; Knoll, J.E. Southern Research Inst., Birmingham, AL (USA). 1989. 23p. Available from NTIS, PC A03/MF A01.

The data from preliminary investigations of the efficiency of dioxin recovery from fly-ash samples during sample extraction and subsequent column cleanup of sample extracts are discussed. Steps of the extraction and the column cleanup procedures were evaluated by using radiolabeled (14)C-dioxins as tracers. Sample extracts and eluate fractions were analyzed by liquid scintillation counting and the results confirmed by gas chromatography/mass spectrometry. Recovery data of spiked 2,3,7,8-tetrachlorodibenzo-p-dioxin-(14)C (TCDD-(14)C) and octachlorodibenzo-p-dioxin-(14)C (OCDD-(14)C) in carbon-free fly ash and fly ash containing from 0.1 to 10% carbon are discussed. The data indicate that the amount of carbon in the fly ash may affect the recovery of dioxins. The data from the study will be used to determine procedural areas that need improvements or modifications to allow the accurate determination of trace levels of dioxins and furans in fly ash. Various extraction techniques of fly ash and cleanup of sample extracts by column chromatography were evaluated. Several chromatographic media and eluting solvents were investigated. Information from this study will support efforts to monitor the hazardous composition, if any, of fly ash from various types of incinerators that use different types of combustible materials, mainly municipal wastes.

0109 Environmental Aspects

26 (DOE/EIS–0146) **Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement.** USDOE, Washington, DC (USA). Nov 1989. 331p. Sponsored by U.S. DOE Fossil Energy. Order Number DE90001890. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

The proposed action evaluated in this PEIS is to continue the Clean Coal Technology Demonstration Program (CCTDP) involving the selection, for cost-shared federal funding, of one or more clean projects proposed by the private sector. The PEIS addresses the potential environmental consequences of the widespread commercialization of the successfully demonstrated clean coal technologies by the private sector in the year 2010. The PEIS evaluates a no-action alternative, which assumes the CCTDP is not continued and conventional coal-fired technologies with conventional flue gas desulfurization controls would continue to be used, and a proposed action alternative, which assumes that CCTDP projects are selected for funding and that successfully demonstrated technologies undergo widespread commercialization by the year 2010. The analysis of environmental consequences focuses on changes to four parameters of concern; namely, sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon dioxide (CO_2), and solid wastes. An upper bound of change to each of these four parameters was estimated for each of 22 clean coal technologies, separately, assuming full penetration of potential markets. Potential effects of the CCTDP on land use, water resources, ecological systems, endangered and threatened species, socioeconomic resources, and human health and safety are also evaluated in the PEIS. 164 refs., 43 figs., 56 tabs.

0110 Reserves and Exploration

27 **Coal reserves. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, September 18, 1987.** S. Hrg. 100-463. 101p. Government Printing Office, Washington, DC (US) (1988).

This hearing reviewed the National Coal Council's Reserve Data Base Report regarding the quality and recoverability of coal reserves. The report pointed out problem areas in the collection and tabulation of the information and raised a question about its reliability and accuracy for decision making on policies such as acid rain and clean coal technologies. Testimony was heard from 11 witnesses, representatives of the coal industry, US Geological Survey, Department of Energy, Kentucky Geological Survey, and representatives from Kentucky and Montana.

0120 Mining

28 (PB–89-216626/XAB) **Trends in coal-mine-dust exposures for longwall miners: 1981-1987.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1988. 16p. Available from NTIS, PC A03/MF A01.

The results of a review of data gathered by coal-mine operators under the requirements of the Mine Safety and Health Administration (MSHA) for longwall coal-mining operations from the year 1981 through 1987 are presented. The dust level in the average coal mine using longwall-mining procedures exceeded 2.0mg/m^3 which was the permissible exposure level (PEL) recommended by MSHA. From 1981 to 1987 the percentage of samples collected that exceeded the PEL were 36, 34, 36, 37, 41, and 38, respectively. Specific longwall occupations studied in the data gathering included the headgate operator, jack setter, shear/plow operator, and tailgate operator. The tailgate operator had the highest degree of exposure of all the workers studied, with the mining method playing an important role in his exposure level. Use of the shear method has been accompanied by increases in the exposure concentrations each year from 1982 through 1987. Examining the data by state indicated that dust levels in Kentucky and Utah have been steadily increasing over the years of the review. Unless the levels of dust exposure are better controlled, the incidence of coal workers' pneumonconiosis can be expected to increase in the future.

0140 Combustion

Refer also to citation(s) 1, 312, 836, 1085

29 (CONF-891130–1) **SO_2-NO_x control in a staged slagging combustor with hydrated lime injection.** Swift, W.M.; Teats, F.G. Argonne National Lab., IL (USA). [1989]. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 3. international conference on processing and utilization of high-sulphur coals; Ames, IA (USA); 14-18 Nov 1989. Order Number DE90001907. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In previous tests at Argonne National Laboratory (ANL), reductions in SO_2 emissions of up to 80% were obtained during the injection of hydrated lime into the first stage of a nominal 2-MW slagging combustor. In the current investigation, six additional tests provided data on SO_2 and NO_x emissions at 20 different test conditions. Nominal test conditions were a coal feed rate of 132 kg/h, an overall combustion stoichiometric ratio of 1.2, Ca/S ratios between 1.4 and 3.8, air preheat temperatures from 55 to 260°C, first-stage combustion stoichiometric ratios from 0.61 to 0.87, and first- or second-stage sorbent injection. Measured reductions in SO_2 emissions ranged from 0% to 94%. The reduction of SO_2 emissions increased with decreasing combustion air preheat temperature and increasing Ca/S ratio. NO_x emissions ranged from 200 to 320 ng/J, with emissions increasing with increasing first stage combustion stoichiometry. These results indicate the potential of staged slagging combustors for controlling SO_2/NO_x emissions during the combustion of high-sulfur coals. 17 refs., 5 figs., 2 tabs.

30 (DOE/MC/24207–2748) **Fossil energy research program: Project status quarterly report, April 1–June 30, 1989.** West Virginia Univ., Morgantown, WV (USA). Energy and Water Research Center. Jul 1989. 308p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-87MC24207. Order Number DE90001703. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

This report reflects the progress performed on the following nine projects: reaction kinetics of the CaO–SO_2 system in absence of inter-grain pore diffusion; deposition, corrosion, erosion and sulfur emission studies related to coal combustion; preliminary study on diagnostic assessment for attrition and erosion in fluidized bed reactors; development of algorithms for capacitance imaging techniques for fluidized bed flow fields; fluidized bed flow patterns; erosion of heat exchanger tubes in fluidized beds; IPSE: a knowledge based system for fluidization studies; implementation of a modified Johnson and Hindmarsh mass and energy transfer model; and theoretical and numerical studies of constitutive relations for frictional granular flow. 23 refs., 39 figs., 12 tabs.

31 (PB–89-165534/XAB) **Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report.** Piper, B.F. KVB, Inc., Irvine, CA (USA). Jun 1985. 148p. Available from NTIS, PC A07/MF A01.

This report describes the results of a test burn of approximately 5000 barrels of H-coal, 1200 barrels of EDS, and 1600 barrels of a mixture of the two coal-derived synthetic fuel oils, conducted at Con Edison's 74th St. Station Boiler No. 122, a tangentially-fired, Combustion-Engineering boiler, rated at 450,000 lbs./hr. steam at 1350 psig and 955 deg F. Baseline testing with No. 6 fuel oil was carried out for comparing boiler performance and flue-gas emissions with the synthetic fuels. The report documents emission measurements and boiler performance measurements, and discusses problems experienced in synthetic-fuel barge unloading and forwarding to the burners. The special industrial-hygiene program developed by plant personnel for handling coal-derived synthetic fuels is also documented.

32 (PB–89-172266/XAB) **Western New York State coal-water fuel market and boiler-conversion study. Final report.** Babcock and Wilcox Co., Alliance, OH (USA). Apr 1987. 115p. Available from NTIS, PC A06/MF A01.

This report examines the feasibility of converting industrial boilers in Western New York to burn coal-water fuel (CWF) and the attractiveness of producing CWF in this region. Use of coal would increase the diversification of fuel supplies. The project began with

a market study to determine the market size and estimate the potential demand for CWF. The project then evaluated the technical and economic feasibility of converting two coal-designed boilers in Western New York, currently firing oil, to CWF. A coal supplier was located and an analysis was made of the options for developing a 315,000 tpy CWF production facility. Adapting an existing site with the facilities for coal receiving, handling, storing, and pollution control, such as a steelmaking facility, would provide the least-cost fuel. Coal-water fuel could be competitive with oil and, to a lesser extent, gas; however, the estimated savings failed to provide an adequate rate of return against the costs associated with converting the industrial boilers at this time.

33 (SAND–89-8250) **Coal combustion science: Quarterly progress report, April–June 1989.** Hardesty, D.R. (ed.). Sandia National Labs., Livermore, CA (USA). Oct 1989. 83p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC04-76DR00789. Order Number DE90001787. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This document provides a quarterly status report of the Coal Combustion Science Program that is being conducted at the Combustion Research Facility, Sandia National Laboratories, Livermore, California. Three tasks are described: Task 1: Coal devolatilization. The objective is to characterize the physical and chemical processes that constitute the early devolatilization phase of coal combustion as a function of coal type, heating rate, particle size and temperature, and gas phase temperature and oxidizer concentration. Task 2: Coal char combustion. The objective is to characterize the physical and chemical processes involved during coal combustion as a function of coal type, particle size and temperature, and gas phase temperature and oxygen concentration. Task 3: Fate of mineral matter during coal combustion. The objective is to establish a quantitative understanding of the mechanisms and rates of transformation of mineral matter in coal combustion environments as a function of coal type, particle size and temperature, the initial forms and distribution of mineral species in the unreacted coal, and the local gas temperature and composition. A particular goal is determining the importance of fragmentation in the evolution of the particle size distribution during coal combustion. 25 refs., 14 figs., 13 tabs.

34 **Coal combustion modeling: Particulate and gas phase heat transfer effects.** Smith, P.J.Q.; Baxter, L.L. 16p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-880348–: American Institute of Chemical Engineers spring national meeting, New Orleans, LA (USA), 6-10 Mar 1988).

Technical Paper 13A.

Heterogeneous heat transfer aspects strongly influence the performance of practical coal combustion systems since many of the subprocesses within the flame are highly temperature sensitive, and since the purpose of most furnaces is to extract energy from the flame. Coal combustion simulation or computer modeling permits investigation of the effect of various heat transfer mechanisms within flames on the many other simultaneous processes of turbulent fluid mechanics, coal conversion, gaseous reaction, etc. This paper examines the global and local effects of two aspects of heat transfer on pulverized coal combustion process: (1) the particle dominated radiation process and (2) the gas phase dominated turbulent convection processes. Comprehensive coal furnace modeling is used to study practical furnaces and the mechanisms are illucidated by comparing predicted results with experimental data from the International Flame Research Foundation (IFRF) pulverized coal trials. The significance of radiative heat transfer is studied and the fraction of the total heat transfer attributable to particle-particle radiation, gas-particle radiation and gaseous emission is quantified. The sensitivity of the radiative components to particle and surface properties (emmittance) is demonstrated. An experimental quantification of coal particle emmittance is also presented. The turbulent transport of energy (convection) is studied and compared to the IFRF trials. The effects of local turbulence fluctuations on the heat transfer and vice versa are presented. A discussion is presented on the significance of local fluctuations of stoichiometry due to turbulence on the fluctuations in local enthalpy and temperature. Implications on utility boiler operation are discussed.

35 **A combustion/deposition entrained reactor for high temperature/pressure studies of coal and coal minerals.** Meyer, C.T.; Anderson, R.J.; Dennis, R.A. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 124D.

The widespread combustion of coal and coal-derived fuels in heat engines poses some technical challenges in terms of establishing very high combustion rates/efficiencies, controlling potential environmental emissions, and minimizing the impact of fuel contaminants on engine components. An entrained reactor has been designed and constructed with special characteristics which allow the study of a number of related phenomena including coal particle combustion, the use of fuel additives on characteristics of both the products of combustion gases as well as the residual ash composition, and the tendency of the residual ash to form deposits on heat engine components. This reactor is designed for high temperature/pressure conditions similar to those of a direct coal-fired combustion gas turbine. The reactor and its applications are discussed here.

36 **Radiant heating of small multiphase fuel droplets.** Sitarski, M.A. (Clarkson Univ. (DOE), Morgantown Energy Technology Center, Morgantown, WV (US)). pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

Current technological advances as well as the difficulties in a preparation and combustion of multiphase fuels (slurries of coal, carbon, boron, etc.) stimulate basic research on properties of dense colloidal dispersions of solid particles in liquids. Direct firing of these fuels in heat engines requires an estimation of the effect of a high temperature thermal radiation on the combustion phenomena because the flame is very luminous, the finely dispersed solid particles are very efficient radiation absorbers and the radiant heat is deposited quite nonuniformly within the fuel droplets. The reported studies are focused on an estimation of necessary conditions for the radiation induced secondary atomization (by an explosive boiling mechanism) of the multiphase fuel droplets when injected into a combustor of a heat engine. Determination of a distribution of the radiant heat sources within the droplets is a starting point of the studies.

0160 Health and Safety

Refer also to citation(s) 28, 1403

37 (CRIE-U–88036) **Accumulation of alveolar macrophages in golden hamster lung after long-term exposure to coal fly-ash particles.** Negishi, Tadashi; Nishimura, Izumi. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1988. 31p. (In Japanese). Order Number DE89901297. Available from NTIS (US Sales Only), PC A03/MF A01.

As a part of evaluation researches on the influences coal fly ash particles have on health, an exposing test of a golden hamster to coal fly ash particles was conducted to clarify the accumulation mechanism of pulmonary alveolar macrophages (AM) caused by long-term exposure and its morphological change with the increase of exposure time, and to clarify the behavior of the newly deposited particle in this part of the alveoli. As a result of continuous 90 day exposure to the coal fly-ash particles of low concentration and of high concentration, the generation number of AM in alveoli proved to be larger with higher exposure concentration and with longer exposure term. As a result of continuous 180 day exposure to low concentration, the conglomeration of AMs which form accumulation became tighter as the term of exposure became longer. And it was also indicated that the polymorphonuclear leukocytes engulf and remove the particles from the parts which form accumulation after long-term exposure. 31 refs., 3 tabs.

0170 Legislation and Regulations

38 **H.R. 402: A bill to amend the Mineral Leasing Act of 1920 with respect to the movement of coal over public lands,**

and for other purposes. Introduced in the House of Representatives, One Hundredth First Congress, First Session, January 3, 1989. 24p. Government Printing Office, Washington, DC (US) (1989).

The purpose of the Coal Pipeline Act of 1989 is to facilitate the development of coal pipelines by granting the Federal power of eminent domain to those coal pipelines that are determined to be in the national interest. Permits would be issued only as permitted by State water law and interstate allocations. No right-of-way would be permitted under this law across wilderness lands or wilderness study areas, national parks, or any land which is part of a historic site of national, state, or local significance. Existing rights-of way are not affected.

39 **H.R. 1376: A bill to amend titles II, V, and VII of the Surface Mining Control and Reclamation Act of 1977 to make the mining of coal without a permit a criminal offense, and for other purposes. Introduced in the House of Representatives, One Hundredth First Congress, First Session, March 13, 1989.** 9p. Government Printing Office, Washington, DC (US) (1989).

This bill amends the 250 ton limit listed in section I. to read 25 ton limit. It would make it a criminal offense to knowingly remove, transport, sell, or purchase coal from a surface mining operation without a permit required by State or Federal governments. A person convicted under this law would be prohibited from obtaining permits for the extraction or processing of coal. Property of the convicted person subject to forfeiture would be all coal involved; all moneys or securities used in the exchange; and all materials, products, implements, machinery, conveyance, equipment, and property of any kind used or intended for use in extracting, conveying, storing, or delivering coal mined in violation of this law.

40 **Amending the Mineral Lands Leasing Act of 1920 with respect to the movement of coal over public lands, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 8, 1988.** Rept. 100-835, Part 1. 39p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Interior and Insular Affairs recommends passage of H.R.1531 as amended by the committee. The purpose of H.R.1531 is to facilitate the development of interstate coal slurry pipelines within the framework of state water law and interstate water allocations. The amendment establishes a procedure through which the Secretary of the Interior may grant the federal power of eminent domain to obtain rights-of-way over private lands to coal pipelines determined to be in the national interest. The Secretary may also grant certified pipelines rights-of-way over federal lands. The pipelines must first obtain any water use permits from the necessary states. The amendment also includes pipelines that would use another media in place of water, such as carbon dioxide. The major issues discussed in this report are certification, employment, state water rights, environment, eminent domain, access over Federal land, and antitrust review.

41 **H.R. 4804: A bill to amend titles I, II, IV and V of the Surface Mining Control and Reclamation Act of 1977, and to add a new title X, to encourage the remining and reclamation of abandoned mined lands by active mining operations, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 14, 1988.** 9p. Government Printing Office, Washington, DC (US) (1988).

Surface coal mining operations can be effective in the reclamation of abandoned mined lands and are being encouraged by the amendments to the existing Surface Mining Control and Reclamation Act of 1977. The new section X - Remining spells out the authority of the Secretary of the Interior to enter into agreements with mining companies to use excess spoil from an active surface mine to reclaim an abandoned site, to develop a bond guarantee program whereby the operators may be compensated with reclamation bond credits for up to 80% of the reclamation costs incurred, and to make funds available on a matching basis to states or tribes to collect certain geologic and hydrologic data for watersheds or regions adversely affected by past coal mining abuses for the use of regulatory authorities to assist applicants for surface mining permits within such areas.

42 **H.R. 5211: Acid Rain Abatement Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 11, 1988.** 33p. Government Printing Office, Washington, DC (US) (1988).

H.R. 5211 would amend the Clean Air Act to provide further controls of certain stationary sources of sulfur dioxides and nitrogen oxides to reduce acid deposition and to provide for the commercialization of clean coal technologies for existing stationary sources. Part E: Acid Deposition Control describes provisions for reductions in emissions of sulfur dioxide and oxides of nitrogen; state plans for sulfur dioxide; emission reduction trading; time extension for Clean Coal Technology projects; emissions cap for existing plants; oxides of nitrogen; and general provisions. Part F: Clean Coal Technologies has sections on definitions; program; research and development not authorized; authorization; and revision of New Source Performance Standards.

43 **Proposed coal product valuation rules. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, November 16, 1987.** S. Hrg. 100-540. 518p. Government Printing Office, Washington, DC (US) (1988).

The hearing was called to discuss the proposed rules issued by the Department of the Interior relating to the valuation of coal production from Federal and Indian leases for royalty purposes. The rules would base the value of coal on the gross proceeds obtained under a contract. The rules would exclude Federal black lung excise tax payments and abandoned mine payments from value, but would include state severance taxes. Considerable controversy arose such that Congress imposed a moratorium on implementation to allow further public comment. An alternative proposal from a joint industry group would base value on the depletable income provisions of the Internal Revenue Code. However, several western governors have voiced concerns over this alternative which analysis shows would result in significantly lower revenues to the Federal government, the states, and to the Tribes. Testimony was heard from eight witnesses, representing the DOI Land and Minerals Management, electric power associations, Western Organization of Resource Councils, the Navajo nation, National Coal Association, and Montana. Additional materials were submitted by the Energy Information Administration, the Western Coal Traffic League, the Western Fuels Association, and the States of Wyoming, North Dakota, Colorado, and New Mexico.

44 **Clean Coal Technology Deployment Act. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 879, May 18, 1987.** S. Hrg. 100-428. 640p. Government Printing Office, Washington, DC (US) (1988).

The text of Senate bill S. 879 is presented in full. It would encourage the deployment of clean coal technologies so as to ensure the development of additional electric generation and industrial energy capacity. The bill would appropriate 350 million dollars per year for a period of 10 years to provide financial assistance to the clean coal technology projects selected by the Department of Energy. The bill would also reduce Federal regulatory impediments to deployment of the technologies. Testimony was heard from 19 witnesses, representatives of public service commissions, Natural Resources Defense Council, electric utilities, Department of Energy, Environmental Protection Agency, Federal Energy Regulatory Commission, and representatives from the states of Kentucky, Louisiana, Idaho, and Oklahoma.

02 PETROLEUM

45 (AD-A-209767/3/XAB) **United States military strategy in the Persian Gulf. Study project.** Whitehead, E.E. Army War Coll., Carlisle Barracks, PA (USA). 27 Mar 1989. 51p. Available from NTIS, PC A04/MF A01.

The importance of Persian Gulf oil, in the context of United States national security has been demonstrated in recent political, economic, and military terms. Substantial United States military resources have been devoted to maintain national security interests in

the Persian Gulf region. This paper analyzes the United States military strategy designed to insure the US and its allies continued access to Persian Gulf oil and to suggest alternatives for possible improvement. Although the focus is on US military strategy in the Persian Gulf, it also covers others aspects of US national security policy and strategy. US military policy in the Persian Gulf is derived from a complex process that inextricably links the elements of national strategy with the elements of national power. Conclusions about US policy and strategy in the Persian Gulf that are properly focused and logical require an understanding of US interests and their priorities; US strategies and their feasibility; plus US capabilities and their limitations.

0201 Reserves

Refer also to citation(s) 48

46 (SAND–89-0821) **Calculation of natural convection boundary layer profiles using the local similarity approach including turbulence and mixed convection.** Webb, S.W. Sandia National Labs., Albuquerque, NM (USA). Jul 1989. 126p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC04-76DP00789. Order Number DE90001887. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Strategic Petroleum Reserve (SPR) cavern fluid velocity model for natural convection uses the Modified Local Similarity (MLS) method to analyze the boundary layer behavior. In order to use the MLS approach, boundary layer velocity and temperature profiles are calculated in terms of local similarity variables based on the natural convection equations. Modifications were made to the local similarity equations enabling consideration of turbulent flow and mixed convection conditions. The details of these changes are addressed in this report. 80 refs., 43 figs., 3 tabs.

0202 Geology and Exploration

Refer also to citation(s) 66, 624, 1322

47 (DOE/BC/14403–2) **Characterization of oil and gas reservoir heterogeneity: Second quarterly report, July 15–October 15, 1989.** Mitchell, A.L. Texas Office of the Governor, Austin, TX (USA). 1989. 12p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89BC14403. Order Number DE90001752. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress in the second quarter of research funded under the auspices of MOU Annex I is summarized with respect to the seven main subtask areas. These are (1) definition of the distribution of carbonate sandbar facies for Grayburg reservoirs; (2) definition of three-dimensional geometry of carbonate sand bodies; (3) analysis of engineering and petrophysical attributes of reservoir flow units; (4) development and testing of extended conventional oil recovery strategies; (5) characterization of gas reservoirs; (6) geologic and engineering characterization of generic gas reservoir types; and (7) refinement of exploitation strategies. Key areas of progress for the July–October quarter concern subtasks 2, 3, 4, and 6. 23 refs., 2 tabs.

48 (DOE/EIA–0523(89/2Q)) **International oil and gas exploration and development activities: Second quarterly report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 1989. 39p. Sponsored by U.S. DOE Management & Administration. Order Number DE90001916. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

This report is part of an ongoing series of quarterly publications that monitors discoveries of crude oil and natural gas in foreign countries and provides an analysis of the reserve additions that result. It is prepared by the Energy Information Administration (EIA) of the US Department of Energy (DOE) under the Foreign Energy Supply Assessment Program (FESAP). A summary of discoveries and reserve additions that result from recent international exploration and development activities is presented. EIA believes that this information is useful to petroleum industry analysts, various government agencies, and political leaders for the development, implementation, and evaluation of energy policy and legislation. A discovery, as used in this publication, is a published estimate of the ultimate recovery for a new field, reservoir, or well. This ultimate recovery is defined in this report as cumulative production plus remaining reserves. These discoveries are obtained from various oil industry periodicals and company annual or quarterly reports. It is important to keep in mind that not all discoveries are announced and not all announced discoveries are published. Some discoveries may be exaggerated or understated for political or other reasons. Therefore, the data in this report should be used with caution. 18 refs., 7 figs., 4 tabs.

49 **Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987.** 600p. Government Printing Office, Washington, DC (US) (1988).

The hearing reviewed the Federal programs in geoscience research, particularly as they relate to the exploration, the characterization, the processing, and ultimately the extraction of our indigenous energy sources. The emphasis of the hearing is on oil and gas recovery, with special attention on the Energy Research Advisory Board's February report on DOE geoscience programs. The geoscience program also focuses on research and nuclear energy supply and research and management of radioactive non-nuclear waste. The US Geological Survey report on uranium supplies is discussed. The major focus of these two days of hearings is to identify ways to ensure availability of adequate supplies of hydrocarbon resources through development and use of advanced methods of characterization and extraction. Further, it looks at the adequacy of the federally funded geosciences efforts and the interaction of those efforts with national laboratories, universities, and the private sector. Testimony was heard from five panels: the US Department of Energy, National Laboratories, Universities, States, and Industry.

0203 Drilling and Production

50 (DOE/BC/10845–15) **Surfactant enhanced volumetric sweep efficiency: Final report.** Harwell, J.H.; Scamehorn, J.F. Oklahoma Univ., Norman, OK (USA). School of Chemical Engineering and Materials Science. Oct 1989. 88p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-85BC10845. Order Number DE89000770. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Surfactant-enhanced waterflooding is a novel EOR method aimed to improve the volumetric sweep efficiencies in reservoirs. The technique depends upon the ability to induce phase changes in surfactant solutions by mixing with surfactants of opposite charge or with salts of appropriate type. One surfactant or salt solution is injected into the reservoir. It is followed later by injection of another surfactant or salt solution. The sequence of injections is arranged so that the two solutions do not mix until they are into the permeable regions well away from the well bore. When they mix at this point, by design they form a precipitate or gel-like coacervate phase, plugging this permeable region, forcing flow through less permeable regions of the reservoir, improving sweep efficiency. The selectivity of the plugging process is demonstrated by achieving permeability reductions in the high permeable regions of Berea sandstone cores. Strategies were set to obtain a better control over the plug placement and the stability of plugs. A numerical simulator has been developed to investigate the potential increases in oil production of model systems. Furthermore, the hardness tolerance of anionic surfactant solutions is shown to be enhanced by addition of monovalent electrolyte or nonionic surfactants. 34 refs., 32 figs., 8 tabs.

51 (DOE/BC/10847–15) **Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report, 1987–1988.** Wasan, D.T. Illinois Inst. of Tech., Chicago, IL (USA). Oct 1989. 131p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-85BC10847. Order Number DE89000772. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Both experimental and theoretical studies are conducted to advance understanding and predictability in the successful application of the combined surfactant-alkali-polymer flooding for tertiary oil recovery. During this past year, experimental studies on the system chemistry were made on alkaline/acidic oil systems with and without added surfactant and/or cosurfactant. The acid was found to play a

major role in the lowering of the interfacial tension in these systems. An interferometric technique was used to observe the presence of ordered structures inside stratifying films formed from micellar solutions of anionic surfactants and other colloidal suspensions. The structural component of the disjoining pressure in thin films with micellar structure, which gives rise to an increased stability in emulsions, foams and colloidal suspensions, has been calculated for the first time. A novel technique for measuring the dilatational viscosity at both the gas-liquid and liquid-liquid interfaces is developed. The measured interfacial dilatational viscosities correlate directly with emulsion and foam stability experiments. 119 refs., 50 figs., 25 tabs.

52 (DOE/MC/22042–15) **Reservoir characterization for the CO_2 enhanced oil recovery process: Final report.** Orr, F.M. Jr. Stanford Univ., CA (USA). Dept. of Petroleum Engineering. Nov 1989. 375p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-85MC22042. Order Number DE89000774. Available from NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This report summarizes progress in a research effort to quantify the effects of nonuniform flow on displacement performance in CO_2 floods. Results are reported in five areas: (1) phase behavior, fluid properties and characterization of crude oils; (2) interactions of phase behavior and multiphase flow in one dimension; (3) interaction of viscous instability and flow in heterogeneous porous media; (4) detection of reservoir heterogeneity; and (5) representation of reservoir heterogeneity. 186 refs., 258 figs., 39 tabs.

53 (PB–89-139323/XAB) **Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987.** Heller, J.P.; Kovarik, F.S.; Taber, J.J. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center. Nov 1988. 342p. (PRRC–87-9). Available from NTIS, PC A15/MF A01.

See also DE88000283.

This report provides results obtained for the third year of a three-year, comprehensive, cost-shared, applied research program designed to improve oil recovery through carbon dioxide (CO_2) flooding. The program was composed of three areas: Task 1–Phase Behavior and Fluid Property Measurements, Task 2–Mixing of CO_2 and Oil During Flow in Reservoir Rocks, and Task 3–Mobility Control in CO_2 Floods. In Task 1, the continuous phase equilibrium apparatus was used to measure simultaneously the viscosity, density, and composition of CO_2-hydrocarbon systems at high pressure. These data were compared to a well-known correlation used in predicting viscosities in reservoir simulation studies. Other work in this area consisted of slim-tube tests using CO_2 and both a synthetic and a crude oil in order to study the effects of methane on optimum oil recovery with CO_2. In Task 2, the performances of secondary and tertiary displacements of crude oil by CO_2 in cores were measured and compared to predictions made with a multicomponent, one-dimensional simulator. Results from the core tests suggest that it may be possible to achieve optimum oil recovery with CO_2 at pressures which are lower than the conventionally obtained optimum pressure estimated from a slim-tube test. In the final part of this task, flow visualization experiments were conducted in glass micromodels to study the effect of micro-heterogeneity on the flow of CO_2 and surfactant-generated foam. In Task 3, procedures and equipment were developed to measure the steady-state mobility of foam-like dispersions of dense CO_2 in surfactant solutions. A number of surfactants were tested, and effects such as surfactant concentration, flowing CO_2 fraction or quality, and permeability of rock samples were studied.

54 **A national laboratory perspective on EOR research and development directions.** Finch, F.T. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 57C.

National security concerns about potential shocks in energy supply that could lead to economic and political disruptions focus on petroleum. It is the most important energy source for the industrial countries and the source for which there is no effective substitute. Numerous recent studies have highlighted the need for new technology, both to locate undiscovered oil in subtle traps and to increase domestic production from known fields through improved means of recovery. The authors have engaged in discussions and questioning and information exchanges with counterparts from several domestic oil companies over the past two years. Here they identify a number of opportunities for developing new technologies that would support the industry in making its contributions to energy security.

55 **CO_2 mobility control by carbonate precipitation: A feasibility study.** Aminian, K.; Ameri, S.; Watts, R.J. 14p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 98H.

CO_2 injection is the most promising enhanced oil recovery method. However, CO_2 has a tendency to bypass a high percentage of reservoir pore volume. This causes early breakthrough and reduces process recovery efficiency. As a result, CO_2 flooding is most economically feasible in today's economy without better CO_2 mobility control. Several methods of mobility control have been attempted with limited success. Therefore, new concepts for controlling the mobility of injected CO_2 are required to increase overall recovery efficiency and economics. The overall objective of this study is to evaluate the feasibility of chemical precipitation to improve CO_2 mobility control. The results of several experiments are discussed here.

56 **Viscous effects in foam rheology.** Kraynik, A.M.; Reinelt, D.A. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 153E.

A micromechanical model for foam rheology is developed by considering 2-D spatially periodic cell structure. Most of the liquid in the foam is associated with Plateau borders. The interfaces of the thin films are assumed to be inextensible. When the foam is deformed, films are withdrawn from or recede into the Plateau borders. For small capillary numbers CA based on the macroscopic deformation rate, the primary film-level viscous flow can be considered quasi-steady and occurs in transition regions where thin films join the Plateau borders The flow induces an excess tension in the thin films, which can vary between films and alter the foam structure. All structural features of the foam are determined by expansions in the small parameter Ca. By accounting for coalescence and separation of Plateau borders, which are associated with very large deformations, the authors determine the instantaneous stress for steady shearing flow. Their quasi-steady analysis is restricted to liquid volume fractions for which the structure evolves smoothly in time.

57 **The incorporation of the effects of CO_2 solubility in brine into a compositional simulator.** Enick, R.M.; Klara, S.M. 17p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 98C.

The effects of the dissolution of carbon dioxide into an aqueous phase containing dissolved solids on the displacement of oil by carbon dioxide evaluated by using a one-dimensional compositional simulator. The Henry constant and partial molar volume of carbon dioxide in water at infinite dilution were determined for the CO_2/H_2O system over the 25°C (77°F) to 250°C (482°F) temperature range and the 4.83 MPa (700 psia) to 72.41 MPa (10,500 psia) pressure range. The decreased solubility of CO_2 in brine is accounted for empirically by a factor correlated to the weight percent of dissolved solids. The effects of dissolved solids on the density and viscosity of the aqueous phase over the 25°C (77°F) to 100°C (212°F) temperature range correlated to the amount of dissolved solids. Ultimate oil recoveries in simulations accounting for the solubility of CO_2 in brine are less than those attained in simulations which did not incorporate solubility of CO_2 in the aqueous phase.

58 **Research directions in enhanced oil recovery.** Singer, M.I.; Stosur, G.I. 27p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 56B.

A survey completed by the National Petroleum Council in June, 1988, included data from companies believed to sponsor about three-quarters of all U.S. private sector research in oil recovery. The results of this survey are reviewed.

59 **EIA Domestic Oil Production Estimates. Hearing before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session, April 29, 1987.** Serial No. 100-51. 118p. Government Printing Office, Washington, DC (US) (1988).

This hearing investigated an error made in estimates published by the EIA in 1986 on domestic oil production. They reported only a minimal decline in domestic production, amounting to about 200,000 barrels per day. Revised figures show that the actual decline in 1986 had been more than 700,000 barrels per day. The errors were made by basing the estimates on older data and by ignoring internal warnings from lower-level officials. Testimony is presented from the Energy Information Administration, the Office of Oil and Gas, and the Dallas Field Office, DOE. Additional materials are included from correspondence with the DOE.

60 **Guidelines help select reservoirs for $NaHCO_3$ EOR.** Lorenz, P.B. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)); Peru, D.A. *Oil and Gas Journal (USA)*, 87(37): 53-57 (11 Sep 1989).

Guidelines have been developed for selecting reservoirs for surfactant-enhanced alkaline flooding with sodium bicarbonate ($NaHCO_3$). Candidate reservoirs for this enhanced oil recovery (EOR) method are difficult to identify because of the lack of data on mineralogy and alkali consumption capacity. Alkalis for EOR have an appeal because of their low cost. But even for oils that are mobilized efficiently on a laboratory scale, field applications of the alkaline process have been disappointing. Recent work has shown that these problems can be ameliorated by the use of sodium carbonate instead of the stronger alkalis, sodium hydroxide (NaOH), or sodium silicate (Na_2SiO_3). The authors have found that sodium bicarbonate ($NaHCO_3$) is even better than sodium carbonate in this regard. This technique shows promise of being cost-effective.

0204 Processing

Refer also to citation(s) 12, 15, 88

61 (EEO-ED-236/242) **Retrofitting of structured packing in an atmospheric distillation column. A demonstration at Phillips Petroleum Ltd., North Tees.** Department of Energy, London (UK). Energy Efficiency Office. Jan 1989. 44p. Order Number DE90713731. Available from NTIS (US Sales Only), PC A03.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Phillips Imperial Petroleum Ltd (PIP) is saving at least Pound 81/hour after replacing valve trays in the gas oil rectification and residue stripping sections of an atmospheric crude distillation tower at its North-Tees refinery. Even at this level of savings, which is considered conservative, the project has a payback period of less than 20 weeks on the original investment of Pound 270,000. A study of the latest distillation technology indicated that the use of structured packing could double the number of theoretical distillation stages in the lower part of the atmospheric tower. The potential benefits were an improvement in the distillate yield, and/or energy savings through a reduction in the amount of residue stripping steam required in the distillation process. Since structured packing had not previously been used in an atmospheric distillation tower for yield improvement, PIP applied for a grant under the Energy Efficiency Demonstration Scheme to lessen the financial risk involved in the project. A grant was awarded and installation was carried out during the 1986 shutdown. Since commissioning at the end of July 1986 the tower has operated satisfactorily and should give added confidence to companies considering adopting this technology. In many cases, the installation of packing will present fewer problems than encountered in this demonstration. (author).

62 **Effect of prehydrogenation on hydroconversion of Maya residuum, part II: Hydrogen incorporation.** Beret, S.; Reynolds, J.G. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-880348--: American Institute of Chemical Engineers spring national meeting, New Orleans, LA (USA), 6-10 Mar 1988).

Technical Paper 44D.

Maya 650^{0}F residuum (Maya AR) was subjected to mild prehydrogenation over a standard hydroprocessing catalyst. The 650^{0}F residuum of this product (HMaya AR) and Maya AR were then subjected to further hydroconversion processing. The products were analyzed by elemental ^{1}H, and ^{13}C NMR analyses to determine the incorporation of hydrogen during processing. For all processing steps, hydrogen was incorporated in capping fragments formed during cracking reactions, as well as in hydrogenation reactions. heteroatom removal, and hydrocarbon gas formation, but the distribution of the hydrogen was dependent upon the severity of the process. In general, 30 to 40% of the total hydrogen was incorporated for heteroatom removal and hydrocarbon gas formation. The remaining hydrogen was incorporated in the cracking and hydrogenation reactions. The hydrogen incorporation of each specific processing step is discussed, along with an evaluation of the prehydrogenation step as a residuum conversion process option. The results are also compared to previously reported hydrogen incorporation measurements on other feeds and processing methods.

0205 Products and By-products

Refer also to citation(s) 78

63 (ORNL–6569) **Navy Mobility Fuels Forecasting System Phase 5 report: Jet fuel conversion by Pacific fuel suppliers and impacts on Navy fuel availability.** Hadder, G.R.; Das, S.; Lee, R.; Domingo, N.; Davis, R.M. Oak Ridge National Lab., TN (USA). Sep 1989. 34p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90000964. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

NATO members have made the commitment to convert land-based jet aircraft from naphtha-type JP-4 jet fuel to kerosene-type JP-8. JP-8 has safety advantages because of its relatively low volatility. With the NATO conversion underway, the US military has conducted market surveys to determine the effects of jet fuel conversion in the Pacific basin. This report describes the application of the economic and engineering models of the Navy Mobility Fuels Forecasting System to predict the effects of jet fuel conversion in the Pacific basin. The primary objective of the study was to estimate the impacts of conversion on the cost and quality of Navy jet and marine fuels. The study predicts that the average cost increase for producing JP-8 instead of JP-4 is 5 cents per gallon. The associated cost increases for Navy fuels are 0.4 cents per gallon for JP-5 jet fuel; 0.2 cents per gallon for F-76 marine diesel fuel; and 0.4 cents per gallon for F-77 burner fuel oil. Conversion has little effect on the quality of Navy fuels. With or without conversion, the study predicts that Navy fuels produced in the US West Coast could have increased tendencies to form gums and other particulates, with potentially adverse impacts on storage stability. 22 refs., 2 figs., 11 tabs.

64 (PB–89-869887/XAB) **High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 100p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868211.

This bibliography contains citations concerning chemical composition and properties, and the testing and utilization of high-temperature lubricants, oils, and hydraulic fluids. Performance evaluations of solid, liquid, and dry lubricants are presented. Self-lubricating materials used in bearings and coatings are also discussed. (This updated bibliography contains 168 citations, 12 of which are new entries to the previous edition.)

0207 Marketing and Economics

Refer also to citation(s) 54, 63, 78

65 (DOE/EIA–0520(89/10)) **International petroleum statistics report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. Oct 1989. 42p. Sponsored by U.S. DOE Management & Administration. Order Number DE90001917. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

This is a monthly publication that provides current international oil data. This report is published for the use of members of Congress, federal agencies, state agencies, industry, and the general public. The report presents data on international oil production, consumption, imports, exports, and stocks. The report has three sections. Section 1 contains time series on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1973, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e. non-communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data beginning in 1982, and quarterly data for the most recent two years.

66 (GAO/RCED–89-6) **Gasoline marketing: States' programs for pump labeling of gasoline ingredients.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 21p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Federal and state governments currently have some gasoline pump labeling requirements. GAO prepared and sent questionnaires to 56 state officials, this included all 50 states, the District of Columbia, Puerto Rico, and 4 U.S. territories, to get their views on gasoline pump labeling practices. Thirty-nine of 50 states responded that their states require retail gasoline stations place labels on their pumps disclosing gasoline ingredients. The various state requirement and programs for gasoline pump labelling are discussed in this article.

67 (PB–89-196885/XAB) **New era of petroleum trading: Spot oil, spot-related contracts, and futures markets. Technical paper.** Razavi, H. International Bank for Reconstruction and Development, Washington, DC (USA). 1989. 131p. (WORLD-BANK-TP–96). Available from NTISMF A01.

Library of Congress catalog card No. 89-5791; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

Although the use of new trade instruments began in the early 1980s and almost all market participants are still learning, petroleum traders of developing countries have lagged behind those in the developed countries. The lag has resulted in the inability of these countries to procure their petroleum requirements at the lowest possible cost. Development of modern trading skills, like that of any other know-how, requires an action plan to build the needed institutions and train the concerned staff. Before preparing an action plan, however, the staff, planners, and policymakers involved in petroleum supply need to acquire a fundamental understanding of the workings and the issues involved in the new era of petroleum trading. The report is intended to provide such an understanding. It provides a detailed description of petroleum spot markets, futures and options trading and their interlinkages with contract sales.

0209 Environmental Aspects

Refer also to citation(s) 77, 1324, 1326, 1440

68 (AD-A–204788/4/XAB) **Artic oil-spill response guide for the alaskan beaufort sea. Final report.** Coast Guard Research and Development Center, Groton, CT (USA). Mar 1988. 334p. (USCG-D–18-88). Available from NTIS, PC A15/MF A01.

Contents include–Federal Response Organization; Initial Response; Elements of Response; Detection and Surveillance, Oil-Spill Trajectory Models, Oil-Spill Containment, Oil-Spill Recovery, Transfer Equipment, Recovered Oil Storage Equipment, Oil-Spill Disposal, Personnel, Logistics, Well Control, Dispersants, Mechanics of Response, Oil Spill Response Scenarios; Appendices.

0210 Legislation and Regulation

Refer also to citation(s) 66, 83, 99

69 **S. 684: Arctic Coastal Plain Competitive Oil and Gas Leasing Act. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 29, 1989.** Calendar No. 34. 66p. Government Printing Office, Washington, DC (US) (1989).

S. 684 would authorize competitive oil and gas leasing and development to proceed on the Coastal Plain of the Arctic National Wildlife Refuge in a manner consistent with the protection of the environment, maintenance of fish and wildlife and their habitat, and the interests of the area's subsistence users; and to provide a new source of funding for: (1) the Land and Water Conservation Fund, (2) the preservation, protection, creation, enhancement, or restoration of wetlands, and (3) research, development, and commercialization of energy conservation and alternative sources.

70 **H.R. 4343: Arctic National Wildlife Refuge Energy Plan Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, March 31, 1988.** 9p. Government Printing Office, Washington, DC (US) (1988).

H.R. 4343 requires the preparation of an energy plan regarding the oil and gas reserves within the Arctic National Wildlife Refuge. The purpose of to ensure that the Congress, prior to approving any recommendation of the Secretary of the Interior concerning the resources of the Coastal Plain, receives a comprehensive long-term plan that includes information on the cost and relative value of exploration and development of such resources compared to energy alternatives; and incorporates energy policy goals of increasing energy efficiency and conservation, minimizing damage to the environment from energy production, and promoting the diversification of domestic supplies of energy resources to reduce vulnerability to a supply disruption.

71 **H.R. 5041: A bill to amend the Export Administration Act of 1979 to restrict the export of certain petroleum products from certain oil refineries. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988.** 4p. Government Printing Office, Washington, DC (US) (1988).

H.R. 5041 would restrict the export of up to 50% of all refined petroleum products and partially refined petroleum products which are produced by an oil refinery which is owned or financed, directly or indirectly, principally by persons other than United States persons and which commences commercial operations on or after the date of enactment of this bill. Refined petroleum product means gasoline, kerosene, distillates, ethane, propane, butane, diesel fuel, and residual fuel oil. Partially refined petroleum products means a mixture of hydrocarbons which existed in liquid phase in underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities, and which has been processed through a crude oil distillation tower.

72 **S. 2096: Canadian Free Trade Agreement Incentive Equalization Act. Introduced in the Senate of the United States. One Hundredth Congress, Second Session, February 25, 1988.** 29p. Government Printing Office, Washington, DC (US) (1988).

It is the purpose of S. 2096 to conform the intent of the US-Canada Free Trade Agreement with the realities of the oil and natural gas market place in North America; and to provide parity between tax burdens and exploration and development incentives provided by the US and similar burdens and benefits conferred by Canada. The sections describe provisions for repealing the Windfall Profits Tax, improving tax treatment of geological, geophysical, and surface casing costs, eliminating net income limitation rule, reforming percentage depletion, repealing transfer rule, crediting marginal production, crediting crude oil and natural gas exploration and development, removing intangible drilling costs from the alternative minimum tax, establishing a procedure to implement a plan to decrease imports whenever foreign oil dependence exceeds 50%, and repealing the taxable income test for percentage depletion.

73 **S. 2643: Oil Pollution Liability and Compensation Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, July 14, 1988.** 41p. Government Printing Office, Washington, DC (US) (1988).

S. 2643 would consolidate and improve Federal laws providing compensation and establishing liability for oil spills. The bill establishes that the owner or operator of a vessel or an onshore or offshore facility from which oil is discharged, or which poses the threat of a discharge which causes the incurrence of removal costs, shall be liable for all removal costs incurred by the US government or a State under provisions of the Clean Water Act, Intervention on the High Seas, or Deepwater Port Act of 1974. The owner/operator is also liable for economic loss or loss of natural resources resulting from such a discharge. However, there is no liability for the owner/operator who can establish that the discharge or threat of discharge was caused by an act of God, and act of war, and act of omission of a third party other than an employee or agent, or any combination the these three.

74 **S. 2770: Oil Pipeline Regulatory Reform Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, September 9, 1988.** 27p. Government Printing Office, Washington, DC (US) (1988).

S. 2770 would amend the Department of Energy Organization Act by adding four new sections: Regulation of pipelines; Common carrier status continued and contracts; Commission rate regulation; and Report to Congress. The text of each new section is presented. The purpose of the bill is to remove the burden of economic regulation from those oil pipeline markets that operate under competitive circumstances or for which such regulation would not be an effective remedy to constrain the exercise of market power; and to provide for continued economic regulation of only those oil pipeline markets for which such regulation will increase economic efficiency and for which the benefits of such regulation outweigh its costs.

75 **H.R. 2851: A bill to amend the Mineral Lands Leasing Act of 1920 to reform the onshore oil and gas leasing program. Introduced in the House of Representatives, One Hundredth Congress, First Session, June 30, 1987, October 15, 1987, November 6, 1987, November 20, 1987.** Union Calendar No. 285. 20p. Government Printing Office, Washington, DC (US) (1987).

The Federal Onshore Oil and Gas Leasing Reform Act of 1987 specifies competitive bidding on leases not larger than 2560 acres, except in Alaska where the maximum is 5760 acres. Royalties are at a rate not less than 12.5% in amount of the production removed or sold from the lease. The Secretary of the Interior does not have to accept the highest bid offered if he determines the bid would not represent a reasonable return to the public. If lands initially required to be leased become available for leasing, the person first making application for the lease qualified to hold it shall be entitled to a lease without competitive bidding. Lands not subject to oil and gas leasing are also described under this legislation.

76 **Federal onshore oil and gas leasing. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress First Session on S. 66, S. 1388, June 30, 1987.** S. Hrg. 100-464. 243p. Government Printing Office, Washington, DC (US) (1988).

The hearing was called to review two Senate bills which would reform the Federal Onshore Oil and Gas Leasing Program. S.66 would provide for competitive leasing for onshore oil and gas and S.1388 would amend the Act of February 25, 1920, to reform Federal leasing procedures. Testimony was heard from 13 witnesses, representing the Bureau of Land Management, National Wildlife Federation, Public Lands Program, Independent Petroleum Association of America, Rocky Mountain Oil and Gas Association, and the states of New Mexico, New Jersey, Arkansas, Louisiana, Montana, and Wyoming. Additional material was submitted by the American Petroleum Institute, the Sierra Club, the Bureau of Land Management, the Montana Environmental Quality Council, and the North Dakota Game and Fish Department.

0220 Transport, Pipelines, and Handling

77 (GAO/RCED–89-37) **Air pollution: Status of dispute over Alaska oil pipeline air quality controls.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 16p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Questions concerning the adequacy of the Alyeska Pipeline Service Company's air pollution controls on the Trans Alaska Pipeline Systems have been raised. In late 1986, the pipeline's oil producers began using a new process that condenses more of the natural gas liquids recovered from their oil fields, resulting in a greater amount of NGLS entering the pipeline and ultimately arriving at the Valdez terminal. These added NGLS increase the volatile organic compounds - a precursor to ozone - emitted from the terminal, raising the issue of whether air quality violations have occurred. The increase in volatile organic compounds and other changes in terminal facilities have led the State of Alaska and the Environmental Protection Agency to conclude that these are major modifications and, therefore, Alyeska should apply to the state for a new air quality control permit. Alyeska disagrees that the modifications warrant a new permit, and the status of the Valdez terminal dispute is discussed in this paper.

0230 Properties

Refer also to citation(s) 56, 57, 63, 743

78 (ORNL–6570) **Navy Mobility Fuels Forecasting System Phase 5 report: Impacts of ultra low sulfur diesel fuel production on Navy fuel availability.** Hadder, G.R.; Das, S.; Lee, R.; Domingo, N.; Davis, R.M. Oak Ridge National Lab., TN (USA). Sep 1989. 37p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90000965. Available from NTIS, PC A03/MF A01 - OST!; GPO Dep.

Legislation for ultra low sulfur (ULS) diesel fuel, with a greatly reduced allowable sulfur content and a new limit on aromatics content, is expected to be in place by 1995. The ULS diesel fuel has been specified to satisfy national standards for particulate emissions from heavy-duty diesel engines. The economic and engineering models of the Navy Mobility Fuels Forecasting System have been used to study the impacts of ULS diesel fuel production on other refined petroleum products, with emphasis on the quality of Navy mobility fuels. The study predicts that to produce ULS diesel fuel, Gulf and West Coast refiners will have to invest about $4.4 billion in new processing capacity. Refiners will shift aromatics from No. 2 diesel fuel to jet fuel and to No. 2 fuel oil. Therefore, particulate emissions could be transferred from the nation's highways to the airways and to communities which use No. 2 fuel oil for residential and commercial heating. The study also predicts that there will be an increase in the aromatics content of domestically produced Navy JP-5 jet fuel and F-76 marine diesel fuel. The gum-forming tendencies of F-76 an F-77 burner fuel oil will increase in most cases. The freezing point of JP-5 will improve. There will be minor changes in the cost of JP-5, but sizable reductions in the cost of F-76 and F-77. 20 refs., 2 figs., 17 tabs.

79 (PB–89-869143/XAB) **Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 100p. Available from NTISPC N01/MF N01.

Supersedes PB–87-868220.

This bibliography contains citations concerning effects; evaluations; and production methods of additives in automotive, aviation, diesel, and boiler fuels. Antioxidant, antiicing, antistatic, corrosion inhibitors, antiknock, and depressant additives relative to evaluations and testing are among the topics discussed. (This updated bibliography contains 223 citations, 56 of which are new entries to the previous edition.)

0240 Storage

80 (PB–89-215164/XAB) **Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems.** Environmental Protection Agency, Washington, DC (USA). Office of Underground Storage Tanks. Dec 1988. 21p. (EPA–530/UST-88/005). Available from NTIS, PC A03/MF A01.

See also PB–89-215172 and PB–89-215180.

The U.S. Environmental Protection Agency has published final regulations concerning financial responsibilities for owners and operators of underground storage-tank systems containing petroleum. This booklet provides a brief summary and answers some important questions about their financial responsibilities. The complete regulations were published in the Federal Register on October 26, 1988; Underground Storage Ranks Containing Petroleum; Financial Responsibility Requirements and State Program Approval Objective; Final Rule 40 CFR Parts 280 & 281.

81 (PB–89-215172/XAB) **Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks.** Kotler, J.D. Environmental Protection Agency, Washington, DC (USA). Office of Underground Storage Tanks. Aug 1988. 20p. (EPA–530/UST-88/006). Available from NTIS, PC A03/MF A01.

See also PB–89-215164 and PB–89-215180.

This booklet was written for owners and operators of underground storage tanks that hold petroleum products such as gasoline, diesel fuel, or oil. The Federal regulations require that these systems have leak detection. The booklet briefly describes external leak detectors. It does not recommend which product to buy or rank equipment from best to worst, but gives background needed on external devices so owners and operators can ask the right questions when speaking to vendors about their products.

82 (PB–89-215180/XAB) **Musts for USTs: A summary of the new regulations for underground storage-tank systems.** Evans, J. Environmental Protection Agency, Washington, DC (USA). Office of Underground Storage Tanks. Sep 1988. 41p. (EPA–530/UST-88/008). Available from NTIS, PC A03/MF A01.

See also PB–89-215172 and PB–89-215164.

The U.S. Environmental Protection Agency has written regulations for many of the nation's underground storage-tank systems. This booklet briefly describes the technical requirements for these systems, which include tanks and piping, for petroleum products and chemicals. The complete regulations were published as Part II of the Federal Register on September 23, 1988; Underground Storage Tanks: Technical Requirements and State Program Approval; Final Rules 40 CFR Parts 280 & 281.

83 **S. 674: A bill to regulate above ground storage tanks having the capacity to store at least one million gallons of petroleum, and for other purposes. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989.** 32p. Government Printing Office, Washington, DC (US) (1989).

S. 674 would amend the Solid Waste Disposal Act by adding a new subtitle J: Regulation of Above Ground Storage Tanks. Within 18 months of enactment of this bill an owner of a storage tank located above ground, with the capacity of at least 25,000 gallons, is required to notify a specified agency of the existence of the tank, its age, size, type, location, assembly history, and uses. Thereafter, an owner has 30 days from the time he brings such a tank into use to notify the agency with the same information. The state is required to make an inventory of all above ground tanks in their state and to give this information to the Administrator of this law. The Administrator will then provide prevention, correction, and financial responsibility regulations applicable to owners and operators as may be necessary to protect human health and the environment.

84 **Strategic Petroleum Reserve Protective force. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988.** Rept. 100-980, Part 1. 13p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Energy and Commerce recommends passage of S.836 with amendment. The amendment bill would permit the arming of Strategic Petroleum Reserve guards, permit SPR guards to make arrests without a warrant, make trespass on SPR sites a Federal offense, and accord SPR guards adequate personal protection from civil and criminal liability should they make reasonable mistakes in discharging a firearm or detaining persons. The proposed legislation would add a new section to the Department of Energy Organization Act.

85 **Security problems at the Department of Energy's Strategic Petroleum Reserve. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, One Hundredth Congress, Second Session, December 7, 1988.** 122p. Government Printing Office, Washington, DC (US) (1989).

The hearing was called to review a General Accounting Office report on a study of security arrangements at SPR sites which raised serious questions about the ability to pump the oil in storage and transport it to where it is needed in the event of acts of sabotage or terrorist attack were coordinated with a foreign supply disruption. The SPR system consists of six depots, four marine terminals, and 240 miles of pipeline. DOE's security program is based on the concept that all facilities cannot be protected against attack, so access to sites is not totally denied. Instead, DOE concentrates on trying to protect certain key areas within facilities and to provide for rapid recovery from any damages inflicted. Testimony was heard from 8 witnesses.

0250 Combustion

Refer also to citation(s) 1085

03 NATURAL GAS

0301 Reserves

Refer also to citation(s) 48

0302 Geology and Exploration

Refer also to citation(s) 48, 49, 624

86 (PB–89-219232/XAB) **Analysis of stratigraphic and production relationships of Devonian-shale gas reservoirs in Ohio. Final report, October 1985-November 1988.** Baranoski, M.T.; Riley, R.A.; Wickstrom, I.H.; Stith, D.A. Ohio Dept. of Natural Resources, Columbus, OH (USA). Div. of Geological Survey. Dec 1988. 71p. Available from NTIS, PC A04.

See also PB–88-178652.

The stratigraphy, structure, and production characteristics of the Devonian-Mississippian shale sequence were evaluated for Lawrence, Meigs, Monroe, Noble, and Washington Counties, Ohio. The computerized data bases for the study consist of permit and completion data for 4,198 wells, geophysical-log tops of 3,555 wells and production records for 898 wells. Naturally completed wells have the highest cumulative production but account for less than 10% of the wells. Hydraulically fractured wells have the highest average initial potential. Structure, isopach, isopotential, and cumulative-production maps all show a northwest-southeast-trending 'grain' in the study area. Numerous stratigraphic and structural anomalies correlate with directional trends on isopotential and cumulative-production maps. This correlation indicates that fracture systems are the primary reservoir for Devonian shale natural gas.

87 **Characterization and significance of natural fractures in Mesaverde Reservoirs at the Multiwell Experiment site.** Finley, S.J. (Sandia Natl. Labs. (US)); Lorenz, J.C. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 19007.

This paper describes natural fractures which dominate the permeability of tight gas reservoirs in the Mesaverde Formation of the Piceance Creek Basin, northwestern Colorado. Roughly 450 natural fractures have been detected in reservoir sandstones and siltstones in 4200 ft of core from the U.S. Department of Energy's Multiwell Experiment (MWX). Sixty percent of the fractures are calcite-mineralized, vertical extension fractures that are probably the greatest contributors to reservoir permeability. However, the contribution of the other mineralized fractures should not be discounted.

0303 Drilling, Production, and Processing

Refer also to citation(s) 12, 86

88 **Oxidative coupling catalyst research for the conversion of natural gas to liquid fuels.** France, J.E.; Ahsan, M.Q.; Shamsi, A.; Headley, L.C. 29p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-880348--: American Institute of Chemical Engineers spring national meeting, New Orleans, LA (USA), 6-10 Mar 1988).

Technical Paper 71A.

Abundant reserves of natural gas exist in locations too remote from market areas to be recovered on a commercial basis by present methods. Hence, the natural gas is often flared or shut in. Morgantown Energy Technology Center is investigating processes that have the potential of being economically viable methods to use this energy resource. One approach is to convert the natural gas to gasoline- or diesel-range hydrocarbons. A new conversion technology with this approach that has commercial potential employs catalytic oxidative coupling as the first step. The oxidative coupling step converts natural gas to olefins with the major reaction being the dimerization of methane to form ethylene. The olefins are subsequently converted to higher hydrocarbons using zeolite-based catalysts. A key to developing this technology is optimizing the oxidative coupling process step. Catalytic oxidative coupling of methane was examined in a fixed-bed laboratory reactor in a cofeeding mode over some perovskite-type oxides and compared with some single component oxides. Of the oxides examined, La-Mn perovskites doped with sodium showed superior C_2 hydrocarbon yields. For $La_{0.8}Na_{0.1}MnO_3$, the C_2 hydrocarbon selectivity increased with increasing temperature up to a maximum value of 63.4 mole carbon percent at 1,093 K. Further increase in temperature resulted in increased formation of carbon oxides. At 1,093 K, 50.6 kPa CH_4, 10.2 kPa O_2, 40.5 kPa He, and 1.35 WHSV CH_4, a methane conversion of 21.0 percent and an oxygen conversion of 93.2 percent were observed.

89 **A simulation study of horizontal, high-angle, and vertical wells in Eastern Devonian shale.** Zammerilli, A.M. (U.S. DOE/METC (US)). vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354--: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 18998.

This study is a comparative evaluation of predicted gas production from horizontal, high-angle, and vertical wells in the tight, fractured Devonian shales of West Virginia. The optimal drilling method was determined by economic and production comparisons of simulation results from studies of unstimulated and stimulated wells of the following types: a single horizontal well, a single high-angle well, and up to four vertical wells. Infill drilling was compared to new-lease wells, and the effect of faulting on predicted gas production was studied. The study showed that new-lease horizontal drilling is the optimal method in West Virginia, and high-angle drilling results in a slight improvement over vertical drilling.

90 **Type curves for predicting production performance from horizontal wells in low-permeability gas reservoirs.** Duda, J.R. (U.S. DOE/METC (US)); Aminian, K. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354--: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 18993.

Type curves have been developed for horizontal wells producing from low permeability gas reservoirs. The general solutions are presented in terms of dimensionless cumulative production and dimensionless time and are grouped based on two other dimensionless variables, the wellbore radius and well length. The type curves were developed using the solutions to flow problems, which were determined using a finite-difference reservoir model. This paper includes a detailed account of the methodology used and comparisons of supporting simulation results to other, general flow solutions that have been previously reported. Issues concerning the production performance of horizontal wells in anisotropic media are also discussed.

0306 Marketing and Economics

Refer also to citation(s) 103

91 (DOE/EIA--0131(88)/1) **Natural gas annual 1988: Volume 1.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 25 Oct 1989. 241p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002646. Available from NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.

The Natural Gas Annual provides information on the supply and disposition of natural gas to a wide audience including industry, consumers, federal and state agencies, and educational institutions. The 1988 data are presented in a sequence that follows natural gas (including supplemental supplies) from its production to its end use. Tables summarizing natural gas supply and disposition from 1984 to 1988 are giving for each Census division and each state. Annual historical data are shown at the national level.

92 (DOE/EIA--0131(88)/2) **Natural gas annual 1988: Volume 2.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 25 Oct 1989. 241p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002647. Available from NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.

The Natural Gas Annual provides information on the supply and disposition of natural gas to a wide audience including industry, consumers, federal and state agencies, and educational institutions. This report, Volume 2, presents historical data for the nation from 1930 to 1988, and by state from 1967 to 1988.

0308 Environmental Aspects

Refer also to citation(s) 1324

93 (DOE/EA--0408) **INGS Pipeline Project, Tennessee Gas Pipeline Company: Environmental assessment.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Aug 1989. 85p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90001110. Available from NTIS, PC A05/MF A01 - OSTI.

The purpose of this environmental assessment is to evaluate the impact resulting from the construction and operation of the proposed facilities required to transport the INGS volumes. Most of the proposed facilities have already been analyzed in the Tennessee/Boundary Looping Project, Final Environmental Impact Statement (Tennessee/Boundary FEIS) issued by the Federal Energy Regulatory Commission (FERC) staff on February 7, 1983, and in the Tennessee/Boundary Looping Project, Environmental Assessment (Tennessee/Boundary EA) issued by the FERC staff on August 30, 1983. Where appropriate, the staff will update, reference, and/or summarize portions of the Tennessee/Boundary FEIS and EA. 17 refs., 25 figs.

0310 Legislation and Regulation

Refer also to citation(s) 69, 70, 72, 75, 76

94 **H.R. 1476: A bill to amend the Internal Revenue Code of 1986 to clarify the application of the credit for producing fuel from a nonconventional source with respect to gas produced from a tight formation and to make such credit permanent with respect to such gas and gas produced from Devonian shale. Introduced in the House of Representatives, One Hundredth First Congress, First Session, March 16, 1989.** 4p. Government Printing Office, Washington, DC (US) (1989).

The determination of whether gas is produced from geopressured brines, Devonian shales, coal seams, or a tight formation is made from section 503 of the Natural Gas Policy Act of 1978. Permanent credit is for gas produced from a tight formation or Devonian shale only and applies to gas sold after July 1, 1987. The credit allowed for any taxable year shall not exceed the sum of the regular tax reduced by the sum of other credits allowable under other subsections of the Internal Revenue Code.

95 **S. 625: Natural Gas Regulatory Reform Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 16, 1989.** 6p. Government Printing Office, Washington, DC (US) (1989).

S. 625 would eliminate artificial distortions in the natural gas marketplace to promote competition in the natural gas industry. It would do this by amending certain sections of the Natural Gas Policy Act of 1978. Title I: Decontrol of Natural Gas describes provisions for elimination of wellhead price controls; coordination with the Natural Gas Act; application to first sales; technical and conforming amendments; effective date (January 1, 1993). Title II: Transitional Provisions describes the decontrol of natural gas subject to a newly executed contract, a renegotiated contract, a terminated contract, or to a contract which expires; coordination with the Natural Gas Act; and effective date (enactment of this bill).

96 **Natural gas contract duration and right of first refusal. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 10, 1988.** Report 100-682. 11p. Government Printing Office, Washington, DC (US) (1988).

The report from the Committee on Energy and Commerce recommends passage of the House bill H.R.2701 to amend the Natural Gas Policy Act of 1978 to remove certain contract duration and right of first refusal requirements. This bill would change Section 315 of the NGPA which is included in this report. The two repeals would cut obstacles and costs for gas buyers and sellers, permit freer trading between them in an already largely decontrolled market, prevent the shutting in of new gas supplies, and allow faster marketing of spot and short-term contract gas.

97 **State taxation of interstate natural gas pipeline property. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 30, 1988.** Report 100-1019. 13p. Government Printing Office, Washington, DC (US) (1988).

The Committee on the Judiciary recommends passage of H.R.2953 with amendment. The proposed legislation would limit the power of states to impose ad volorem taxes on interstate natural gas transmission property and to grant concurrent jurisdiction to US district courts to enjoin the collection of taxes above this limit. It would prevent states and local jurisdictions from taxing interstate natural gas pipelines at a higher level than other commercial or industrial property by limiting both the tax rate applied and the level of assessment placed on such property when compared to its true market value and provides federal courts to litigate disputes arising under this last provision.

98 **H.R. 2266: Pipeline Safety Reauthorization Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, April 21, 1988.** 26p. Government Printing Office, Washington, DC (US) (1988).

This bill would amend the Natural Gas Pipeline Safety Act of 1968 and the Hazardous Liquid Pipeline Safety Act of 1979 to authorize appropriations for fiscal years 1988 and 1989. The bill describes certification, state notification and pipeline inventory, state enforcement, qualifications for state grant programs, Federal-State cooperation in case of accident, destruction of signs or markers, additional inspection and testing, feasibility of regulating excavation activities, and authorization for appropriations for natural gas and hazardous liquid pipelines. This bill would also specifically regulate the transport of carbon dioxide. Sections are included on grants-in-aid, additional hirings, minimum requirements for one-call notification systems, internal inspection of pipelines, and emergency flow restricting devices.

99 **Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989.** S. Hrg. 101-45. 242p. Government Printing Office, Washington, DC (US) (1989).

The hearing was called to consider two bills. S.388 would amend the Department of Energy Organization Act to create five-year staggered terms for the Commissioners of the Federal Energy Regulatory Commission in order to promote continuity of policy making and experience of the Commissioners of this Federal agency that regulates the natural gas, electric power, and oil pipeline industries. S.389 would create on Assistant Secretary for Natural Gas within the Department of Energy to promote the recognition in the Department's organizational structure of the significant part that natural gas can play in the nations's energy future. The text of both bills is presented. Testimony was heard from 12 witnesses.

0320 Transport, Pipelines, and Handling

100 (PB–89-219240/XAB) **State-of-the-art interior piping systems applications: Single-family buildings. Final report, January 1985-December 1986.** Torbin, R.N.; Belkus, P. Foster-Miller Associates, Inc., Waltham, MA (USA). Nov 1988. 259p. Available from NTIS, PC A12/MF A01.

See also PB–88-141627.

State-of-the-art interior gas-piping technology, which includes steel pipe, copper tubing, and corrugated stainless steel tubing, was evaluated through a series of installation studies in two different types of single-family dwellings. Side-by-side comparisons were made between steel pipe and semirigid tubing in terms of installation labor and material costs. The results of the installation studies indicated that semirigid tubing is a more cost-effective approach than steel pipe for single-family homes. The semirigid tubing system can be operated at low pressure or by using the hybrid-pressure approach. Field data were used to estimate the impact of semirigid tubing systems on other single-family housing styles. Additional studies were conducted to investigate other issues involved with the use and long-term acceptance of semirigid tubing. These studies included: an assessment of the issues involved with the use of copper tubing; the need for mechanical protection of concealed semirigid tubing; and constraints of the gas-distribution system (street pressure, service regulators, and gas meters) affecting the use of the hybrid-pressure approach. An evaluation of the SMART HOUSE concept was performed to assess if innovative gas piping, modified gas appliances, and advanced control systems could be integrated.

101 (PB–89-230650/XAB) **Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988.** Coose, J.P.; Firey, B.; Zinsmeyer, C.D. BDM Corp., Austin, TX (USA). Jun 1988. 43p. Available from NTIS, PC A03/MF A01.

See also PB–87-209979.

This document discusses the results of Tasks I through V of the GRI Contract 'A Robot Which Will Investigate the Condition of Underground Pipe.'

0330 Properties

Refer also to citation(s) 933

0340 Combustion

Refer also to citation(s) 312, 1085

102 (PB–89-173694/XAB) **Evaluation of auxiliary-power subsystems for gas-engine heat pumps. Topical report, April 1987-October 1988.** Rasmussen, R.W.; Wahlstedt, D.A.; Planer, N.; Fink, J.; Persson, E. Honeywell, Inc., Golden Valley, MN (USA). Corporate Systems Development Div. Dec 1988. 110p. Available from NTIS, PC A06/MF A01.

The project addresses the need to determine the practical, technical, and economic viability for a stand-alone Gas Engine Heat Pump (GEHP) system capable of generating its own needed electricity. Thirty-eight reasonable design configurations were conceived, based upon small-sized power-conversion equipment either commercially available or close to market. Nine of these configurations were analyzed due to their potential for low first cost, high conversion efficiency, availability, or simplicity. It was found that electric consumption can be reduced by over 60% through the implementation of high-efficiency, brushless, permanent magnet motors as fan and pump drivers. Of the nine selected configurations employing variable-speed fans, two were found to have simple incremental payback periods of 4.2 to 16 years, depending on the U.S. city chosen for analysis. Although the auxiliary power subsystem option is

only marginally attractive from an economic standpoint, the increased gas load provided to the local gas utility may be sufficient to encourage further development. In addition, the ability of such a system to operate completely disconnected from the electric power source may be another feature that has high merit in certain markets.

103 (PB–89-219265/XAB) **Assessment of technology for self-powered gas appliances: A GATC (Gas Appliance Technology Center) task report, July 1988-January 1989.** Weller, A.E.; Stickford, G.H. Battelle Columbus Div., OH (USA). 31 Jan 1989. 165p. Available from NTIS, PC A08/MF A01.

This study assessed the potential technical and economic feasibility of self-powered appliances, and identified candidate appliances and matching energy technologies for self-powered appliances. This assessment included residential and small commercial appliances that have a potential for near-term application.

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, and Mining

Refer also to citation(s) 162

104 (EGG-M–88320) **Oil shale mining and material handling: Considerations for future research and development.** Smith, R.P.; Knutson, C.F. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-881128–2: Eastern oil shale symposium, Lexington, KY (USA), 30 Nov - 2 dec 1988). Order Number DE90002054. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In order to replace present United States oil imports by the production of shale oil, 15 million tons/day of oil shale would have to be mined and processed. Design of mining systems, capable of very large production rates and high resource recovery, should be the foremost concern. At present, open pit, block caving, and various stopping systems appear promising. Existing mechanical mining machines are capable of high drivage rates in oil shale; underground mines should be designed to take advantage of their development speed. The strength of some oil shales is such that present day mining machines using dragbits (e.g., roadheaders) are severely taxed, and therefore, may see only limited use in mine development. Research has been done in revolutionary rock fragmentation techniques (e.g., electric, electromagnetic, particle beam, and plasma fragmentation), but their application to practical, large volume mining systems is presently constrained by high cost and operational complexity. Research aimed at other aspects of the mining systems (roof support, transport, blasting efficiency, ventilation, backfill, and reclamation) is more likely to produce significant near term benefits. 11 refs., 1 fig., 1 tab.

0404 Oil Production, Recovery, and Refining

105 (DOE/LC/11066–2719-Vol.2) **Beneficiation-hydroretort processing of US oil shales: Volume 2: Final report.** Alabama Univ., University, AL (USA). School of Mines and Energy Development; Hycrude Corp., Chicago, IL (USA); Institute of Gas Technology, Chicago, IL (USA). Jan 1989. 470p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG21-85LC11066. Order Number DE89011685. Available from NTIS, PC A16/MF A01 - OSTI; GPO Dep.

This report has been divided into three volumes. Volume I describes the MRI beneficiation work. In addition, Volume I presents the results of joint beneficiation-hydroretorting studies and provides an economic analysis of the combined beneficiation-hydroretorting approach for processing Eastern oil shales. Volume II presents detailed results of hydroretorting tests made by HYCRUDE/IGT on raw and beneficiated oil shales prepared by MRI. Volume III comprises detailed engineering design drawings and supporting data developed by the Roberts and Schaefer Company, Engineers and Contractors, Salt Lake City, Utah, in support of the capital and operating costs for a conceptual beneficiation plant processing an Alabama oil shale.

106 (DOE/LC/11066–2719-Vol.3) **Beneficiation-hydroretort processing of US oil shales, engineering study: Volume 3, Final report.** Johnson, L.R.; Riley, R.H. Alabama Univ., University, AL (USA). School of Mines and Energy Development; Roberts and Schaefer Co., Salt Lake City, UT (USA). Dec 1988. 357p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG21-85LC11066. Order Number DE89011686. Available from NTIS, PC A16/MF A01 - OSTI; GPO Dep.

This report describes a beneficiation facility designed to process 1620 tons per day of run-of-mine Alabama oil shale containing 12.7 gallons of kerogen per ton of ore (based on Fischer Assay). The beneficiation facility will produce briquettes of oil shale concentrate containing 34.1 gallons of kerogen per ton (based on Fischer Assay). The beneficiation facility will produce briquettes of oil shale concentrate containing 34.1 gallons of kerogen per ton (based on Fischer Assay) suitable for feed to a hydroretort oil extraction facility of nominally 20,000 barrels per day capacity. The beneficiation plant design prepared includes the operations of crushing, grinding, flotation, thickening, filtering, drying, briquetting, conveying and tailings empoundment. A complete oil shale beneficiation plant is described including all anticipated ancillary facilities. For purposes of determining capital and operating costs, the beneficiation facility is assumed to be located on a generic site in the state of Alabama. The facility is described in terms of the individual unit operations with the capital costs being itemized in a similar manner. Additionally, the beneficiation facility estimated operating costs are presented to show operating costs per ton of concentrate produced, cost per barrel of oil contained in concentrate and beneficiation cost per barrel of oil extracted from concentrate by hydroretorting. All costs are presented in fourth quarter of 1988 dollars.

107 (UCRL–101859) **Pyrolysis kinetics applied to prediction of oil generation in the Maracaibo Basin, Venezuela.** Sweeney, J.J.; Talukdar, S.; Burnham, A.K.; Vallejos, C. Lawrence Livermore National Lab., CA (USA). Sep 1989. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48. (CONF-890920–2: 14. international conference on organic geochemistry, Paris (France), 18-22 Sep 1989). Order Number DE90001504. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We use chemical kinetic parameters for oil generation derived from modified Rock-Eval and Pyromat instruments, coupled with thermal history models, to predict the timing and extent of oil generation in the Maracaibo Basin of Venezuela. The vitrinite reflectance model developed at Lawrence Livermore National Laboratory is used to calibrate thermal history models with measured vitrinite reflectance profiles. We examine the way differences in the kinetic parameters affect predictions of oil maturation in several parts of the basin with different thermal histories. Maturity indicators, such as H/C atomic ratio and API gravity, are compared to the calculated extent of oil generation. We use the comparison to check the accuracy of the coupled oil generation and thermal history models. 20 refs., 13 figs.

0405 Properties and Composition

Refer also to citation(s) 22, 105

0420 Regulations

108 **H.R. 643: A bill to amend section 37 of the Mineral Leasing Act relating to oil shale claims, and for other purposes. One Hundredth First Congress, First Session, January 24, 1989, May 14, 1989.** Union Calendar No. 31. 10p. Government Printing Office, Washington, DC (US) (1989).

Certain oil shale mining claims filed under the General Mining Law of May 10, 1872 that were maintained in compliance with that law were upheld by section 37 of the Mineral Leasing Act of 1920. Since almost none of the oil shale claims have been developed for their oil shale in the intervening 69 years, Congress wishes some final resolution of these claims so that Federal lands affected may be properly managed for their mineral resources. Therefore this bill

would require holders of claims to elect either to apply for a lease for the deposit or to apply for a patent and develop the deposit. A lease would be good for 20 years or for so long as oil shale or associated minerals are produced annually in commercial quantities. A patent requires diligent efforts toward the production of oils shale or associated minerals each year that commercial production is not attained. Payments in lieu of diligent development are allowed equal to 5000 dollars per year payable to the Secretary of the Interior.

109 **House Concurrent Resolution 391 [supporting the government of Alberta in a feasibility study for extracting oil from oil sands and the US company which has developed a new solvent extraction technology]. Introduced in the House of Representatives, One Hundredth Congress, Second Session, October 18, 1988.** 3p. Government Printing Office, Washington, DC (US) (1988).

This resolution recommends the US government support the Provincial Government of Alberta, Canada, in a feasibility study for extracting oil and other materials from the Athabasca deposit. The study would answer questions about the potential of tar sands in both the US and Canada and at the same time would support a US company which has developed a new solvent extraction method. The Athabasca deposit not only shows potential for oil production but in the recovery of titanium, zirconium, and other minerals which are classified as strategic by the US Department of Defense. The Solv-Ex Process is an environmentally benign solvent extraction technology developed by the Solv-Ex Corporation of Albuquerque, New Mexico.

110 **Oil Shale Mining Claims Conversion Act. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2089, H.R. 1039, April 22, 1988.** S. Hrg. 100-744. 310p. Government Printing Office, Washington, DC (US) (1988).

The hearing was called to examine two bills which address the processing of oil shale mining claims and patents by the Department of the Interior under the General Mining Law of 1872. S.2089 would provide for certain requirements relating to the conversion of oil shale mining claims located under the Mining Law of 1872 to leases and H.R.1039 would amend section 37 of the Mineral Lands Leasing Act of 1920 relating to oil shale claims. Under the new bills the owners of oil shale mining claims must make an election within 180 days after enactment as to whether to convert their claims to leases or to maintain their claims by performing 1000 dollars of annual assessment work on the claim, filing annually an affidavit of assessment work performed, and producing oil shale in significant marketable amounts within 10 years from the date of enactment of the legislation.

05 NUCLEAR FUELS

Refer also to citation(s) 478

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 200, 201

0504 Feed Processing

Refer also to citation(s) 926

111 (EGG-M–88287) **Determination of thorium, uranium and transuranium isotopes in siliceous and refractory materials by high-resolution alpha spectrometry.** Sill, C.W.; Sill, D.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8810112–9: 34. annual conference on bioassay, analytical and environmental radiochemistry, Las Vegas, NV (USA), 17-21 Oct 1988). Order Number DE90002093. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Samples of siliceous solids up to 1 gram were dissolved completely by fusion with potassium fluoride in platinum dishes in the presence of appropriate isotopic tracers. The fluoride cake was then transposed with concentrated sulfuric acid to a pyrosulfate fusion with simultaneous volatilization of all silica and fluoride. Thorium and the transuranium elements were precipitated isomorphously with barium sulfate. Thorium and transuranium elements were precipitated as hydroxides, filtered on a membrane filter and analyzed in an alpha spectrometer. When much natural thorium-232 was present, the hydroxides were converted to fluorides before analysis by alpha spectrometry. Uranium was precipitated isomorphously with barium sulfate. The uranium was precipitated consecutively as the hydroxide and fluoride for mounting and analysis by alpha spectrometry. The procedure was much simpler and faster than others available. Resolution of the subsequent alpha spectra was comparable to that obtained by electrodeposition. When sufficient activity was present, the results could be reproduced with a relative standard deviation of about 1% for the entire determination. The accuracy of the determination on standards was always as good as the statistical uncertainty of the measurement would permit.

112 (INIS-BR–1659) **Contribution to calculation of distribution coefficient of the Uranium using solvent extraction.** Goldenberg, J.F. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1982. 8p. (In Portuguese). (CONF-8212117–: 1. meeting of Southern Hemisphere on mineral technology and 9th national meeting on mineral treatment and hydrometallurgy, Rio de Janeiro (Brazil), 5-10 Dec 1982). Order Number DE90606321. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A chemical model for uranium extraction from sulfuric solutions and tri-alkylamines as extracting agents is studied. The chemical samples UO_2^{2+}, UO_2SO_4, $UO_2(SO_4)_2$, $SO_4^=$ and H^+ in aqueous phase, as well as calculation of the distribution coefficient (Du) in function of uranium concentration in aqueous phase are analysed. (M.J.C.).

0505 Uranium Enrichment

Refer also to citation(s) 924

0507 Fuels Production and Properties

Refer also to citation(s) 209, 210, 337, 375, 392, 475, 838, 930, 969, 1000

113 (CONF-891103–36) **Improvements in fabrication of metallic fuels.** Tracy, D.B.; Henslee, S.P.; Dodds, N.E.; Longua, K.J. Argonne National Lab., Idaho Falls, ID (USA). Dec 1989. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE90001925. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Argonne National Laboratory is currently developing a new liquid-metal cooled breeder reactor known as the Integral Fast Reactor (IFR). IFR fuels represent the state-of-the-art in metal-fueled reactor technology. Improvements in the fabrication of metal fuel, to be discussed below, will support the fully remote fuel cycle facility that as an integral part of the IFR concept will be demonstrated at the EBR-II site. 3 refs.

114 (WHC-SA–0548) **Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion.** Clemans, W.H.; Conlin, K.E. Westinghouse Hanford Co., Richland, WA (USA). Sep 1989. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8911101–1: ASM conference on methods for reducing scrap in producing tubes, bars and shapes, Clearwater, FL (USA), 6-7 Nov 1989). Order Number DE90001241. Available from NTIS, PC A03/MF A01 - OSTI.

Westinghouse Hanford has developed a new driver element for production of special nuclear material through neutron bombardment of a target element in a nuclear reactor. The driver element is a tube fabricated using zirconium/9.3 wt % enriched uranium alloy clad ID and OD with metallurgically bonded Zircaloy-2. Because of the high cost of the core material, it was necessary to reduce the scrap losses due to coextrusion unbond and end effects to well below those produced by historic fabrication methods. Coextrusion

equipment, process, and billet design to accomplish this will be described.

115 (WHC-SA-0603) **Seismic qualification of safety class components in existing non-reactor nuclear facilities at Hanford Site.** Ocoma, E.C. Westinghouse Hanford Co., Richland, WA (USA). Sep 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910192--13: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90001128. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents the methods used during the walkdowns to compile as-built structural information to seismically qualify or verify the seismic adequacy of safety class components in the Plutonium Finishing Plant complex. The Plutonium Finishing Plant is a non-reactor nuclear facility built during the 1950's and was designed to the Uniform Building Code criteria for both seismic and wind events. This facility is located at the US Department of Energy Hanford Site near Richland, Washington. 2 figs.

116 **The human factor in first-year operations.** Perkins, W.C.; Durant, W.S. *Transactions of the American Nuclear Society (USA)*, 57: 74 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper addresses the reliability of the worker, in comparison to equipment performance, in the first year of operation of a nonreactor facility. The facility chosen for this study is located at the Savannah River Plant (SRP) in South Carolina and is operated for the US Department of Energy by E.I. du Pont de Nemours and Company. In these operations, chemical processes convert uranium compounds into the form required in the manufacture of reactor fuel. Studies of some mature facilities have concluded that human errors, more often than equipment failures, are the main causes of process incidents. For a new plant in preparation for its first year of operation, one could expect equipment failures to dominate until plant checkouts and cold runs are complete. Then, in the first year of operation, the equipment should perform much better than newly trained personnel; this study confirms that expectation.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 211, 413, 925, 1003, 1004

117 (BMU-1989-224/1) **Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Linde A.G., Hoelriegelskreuth (Germany, F.R.). Dec 1988. 290p. (In German). Contract BMU St.Sch. 971. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The study promoted by the German Federal Ministry for Reactor Safety (BMU) within the scope of the research work St.Sch. 971 compares three procedures for the Kr85 removal from a reprocessing plant having a capacity of 350 t per year: Low temperature rectification, freon gas scrubbing, adsorption on activated carbon at low temperatures. These three procedures are compared with respect to technical criteria and from the point of view of safety and radiology; special importance is paid to the comparison of the radiological effects. For that purpose, process and engineering design of procedures and component parts has been considered, safety reflections with regard to failure analyses have been made, as well as the determination of radiation exposure concerning operating personnel and the population in the surroundings at normal operation conditions, and at failures. (orig.).

118 (CONF-891103--25) **Criticality safety analysis of a borated-concrete absorber.** Funabashi, H.; Oka, T.; Matsumoto, T.; Smolen, G.R. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89016267. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Fuel cycle facilities use slab tanks to store fissile solutions, because these tanks have both a high volume-to-floorspace efficiency and an easily verifiable, criticality control (thickness). The results of preliminary criticality analyses using a validated computer code and cross-section library, indicate that a slab tank designed without a solid neutron absorber is not economical in view of process requirements (inventory) and space limitations (layout). A subsequent calculational study assessed the possible increase in the thickness of a single, isolated slab tank using a solid neutron absorber. Finally, an analysis was performed to evaluate the maximum slab thickness for an array of tank/absorbers. The result of these studies showed the potential for expansion of slab tank thickness. 7 refs., 5 figs., 7 tabs.

119 (CONF-891103--26) **Summary of experimental and calculational results from the joint USDOE/PNC criticality data development program.** Smolen, G.R.; Koyama, T. Oak Ridge National Lab., TN (USA). [1989]. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89016290. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A joint exchange program on the subject of criticality data development was completed in August 1988. The program was between the US Department of Energy (DOE) and the Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan. The primary purpose of the program was to perform critical experiments to allow validation of computer codes and cross-section libraries used for safety analyses for facilities that recycle nuclear fuel. The experiments spanned the range of neutron spectra from the very under-moderated condition (H/Pu ratio=22) to the very over-moderated condition (H/Pu ratio=2220). Based on computations performed at the Oak Ridge National Laboratory (ORNL), the average calculated k-effective for these experiments is 1.004. Calculated k-effectives ranged from 0.991 to 1.021, and the standard deviation of these results is 0.006. PNC staff have obtained similar calculational results in their validation studies. The good agreement between experiment and calculation gives confidence that the calculational methods can be applied to similar plant conditions. 18 refs., 5 figs., 6 tabs.

120 (CONF-891118--8) **Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique.** Spriggs, G.D.; Hansen, G.E.; Martin, R.E.; Plassmann, E.A.; Pederson, R.A.; Schlesser, J.A.; Krawczyk, T.L.; Smolen, G.R.; Tanner, J.E. Oak Ridge National Lab., TN (USA). [1989]. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From International meeting on nuclear criticality safety margins; San Francisco, CA (USA); 26 Nov - 1 dec 1989. Order Number DE89017764. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Subcritical measurements of the WINCO slab tank using the source-jerk techniques are presented. This technique determines subcriticality by analyzing the transient response produced by the sudden removal of an extraneous neutron source (i.e., a source jerk). We have found that the technique can provide an accurate means of measuring k in configurations that are close to critical (i.e., $0.90 < k < 1.0$). As the system becomes more subcritical (i.e., $k < 0.90$), spatial effects introduce significant biases depending on the source and detector positions. A comparison between the measurements and Monte Carlo code calculations is also presented. 15 refs., 6 figs., 2 tabs.

121 (DPST-89-348) **Benzene/nitrous oxide flammability in the precipitate hydrolysis process.** Jacobs, R.A. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 18 Sep 1989. 48p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90001318. Available from OSTI; GPO Dep.

The HAN (hydroxylamine nitrate) process for destruction of nitrite in precipitate hydrolysis produces nitrous oxide (N2O) gas as one of the products. N2O can form flammable mixtures with benzene which is also present due to radiolysis and hydrolysis of tetraphenylborate. Extensive flame modeling and explosion testing was undertaken to define the minimum oxidant for combustion of N2O/benzene using

both nitrogen and carbon dioxide as diluents. The attached memorandum interprets and documents the results of the studies.

122 (INIS-mf-12022) **Calculation of concentration profiles and their experimental verification with a pulsed sieve-plate column and the reactive material system of uranyl nitrate, nitric acid/tributyl phosphate, kerosine.** Ihle, E. Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften. 7 Feb 1985. 374p. (In German). Order Number DE90717899. Available from NTIS (US Sales Only), PC A16/MF A01.

The present study is concerned with the calculation of stationary and non-stationary concentration profiles as well as with the starting and disturbance behaviour of a pulsed sieve-plate extraction column. It investigates into the material system HNO_3/uranyl nitrate in water with 30 per cent by volume of tributyl phosphate in kerosine. During the measurements of the concentration profiles for HNO_3 transition, which were effected in the direction of extraction and re-extraction, it was shown that the concentration profiles measured in the mixer-settler range, in spite of a sixfold enlargement of the specific heat transfer area, do not differ essentially from those measured in the dispersion range. During the measurements of concentration profiles for HNO_3/uranium transition, which were effected in the direction of coextraction and co-reextraction only for mixer-settler range, it was discovered that with increasing phase ratios, there is a depletion of the uranium concentration in the aqueous phase. If the phase ratio is further raised, it is the nitric acid, and not the uranium, that is depleted. (orig./PW).

123 (PB–89-870109/XAB) **Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 55p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867619.

This bibliography contains citations of selected patents concerning Sol-Gel processes and Sol-Gel derived materials and products. Selected patents include Sol-Gel compositions, ceramic and refractory materials, fabrication of silica glass, Sol-Gel thin films and coatings, transparent inorganic oxide glass, luminescent quartz glass, catalysts and catalyst supports, nuclear fuels preparation, abrasives for grinding wheels, Sol-Gel production of microspheres, alumina composites, photographic materials, and dental materials. (This updated bibliography contains 108 citations, 37 of which are new entries to the previous edition.)

124 **Water filtration problems at the Idaho Chemical Processing Plant Fuel Storage Area.** Christensen, A.B.; Childs, K.F.; Wolfram, J.H. *Transactions of the American Nuclear Society (USA)*, 57: 89-91 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The new fuel storage area (FSA) began operation at the Idaho Chemical Processing Plant in mid-1984. The FSA water treatment system is designed to provide a high standard of purity to the storage pool water. The filters, which are an important part of this system, have shown a tendency to foul during the last 4 yr. The cause of the filter fouling and the steps taken to prevent it are described in this paper.

0509 Transport and Storage

Refer also to citation(s) 197, 204, 205, 206, 207, 208

125 (CONF-891103–20) **Evaluation of shielding analysis methods for spent fuel casks.** Parks, C.V. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89015893. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Accurate results from shielding analyses of spent fuel casks are increasingly important as the desire for optimized designs increases. ALARA concerns also contribute to the need for accurate dose evaluations for casks. Three areas require the attention of cask shielding analysts — radiation source generation, utilization of cross-section data, and the radiation transport and dose evaluation. This paper reviews recent efforts carried out at Oak Ridge National Laboratory (ORNL) to evaluate the impact of various codes, data, and analysis assumptions on the calculation of radiation doses from spent fuel casks. 9 refs., 1 tab.

126 (GA-A–19701) **Inherent criticality safety margins in spent fuel transportation casks.** Boshoven, J.K.; Su, Shiaw-der. General Atomics Co., San Diego, CA (USA); EG and G Idaho, Inc., Idaho Falls, ID (USA). Nov 1989. 7p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC07-88ID12698;AC07-76ID01570. (CONF-891103–12: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989; EGG-M–89305). Order Number DE89014851. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Criticality safety margins are inherent in spent fuel transportation casks, as accompanied by fuel burnup. Fuel burnup basically provides built-in poison for criticality control as a result of the depletion of fissile material and buildup of fission product absorbers. This paper illustrates the extent of the safety margin as a function of fuel burnup and its sensitivity to initial ^{235}U enrichment for spent fuel in the GA-4 transportation cask, which is being developed to carry four fuel assemblies from pressurized water reactor (PWR) plant. The basis and method used in determining the safety margins is also presented. 5 refs., 5 figs., 2 tabs.

127 (GAO/RCED–89-61FS) **Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 16p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Questions related to an earlier GAO report on the Rocky Flats Plant near Denver, Colorado, are answered in this paper. GAO findings include: Sandia National Laboratory's risk analyses associated with shipping plutonium under the four alternatives did not consider potential human error because a Sandia staff member believed that it would not affect the risk calculations, the Department of Energy's container used for transporting oxides has not been tested for durability since it was put into service in 1984, radiological risk to Rocky Flats workers would continue because the relocation alternatives would not eliminate all operations involving plutonium at the plant, and waste and scrap materials would continue to be generated form existing operations.

128 (PNL–6838) **Reactivity measurements on an experimental assembly of 4.31 wt % ^{235}U enriched UO_2 fuel rods arranged in a shipping cask geometry.** Bierman, S.R. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 78p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (TTC–0895). Order Number DE90001880. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

A research program was initiated for the US Department of Energy (DOE) Sandia National Laboratory Transportation Systems Development Department in 1982 to provide benchmark type experimental criticality data in support of the design and safe operations of nuclear fuel transportation systems. The overall objective of the program is to identify and provide the experimental data needed to form a consistent, firm, and complete data base for verifying calculational models used in the criticality analyses of nuclear transport and related systems. A report, PNL-6205, issued in June 1988 (Bierman 1988) covered measurement results obtained from a series of experimental assemblies (TIC-1, 2, 3 and 4) involving neutron flux traps. The results obtained on a fifth experimental assembly (TIC-5), modeled after a calculational problem of the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) Committee on the Safety of Nuclear Installations (CSNI) Working Group, are covered in this report. 10 refs., 10 figs., 7 tabs.

129 **Long-term materials testing of transportable storage cask containment and basket materials.** Ottinger, C.A.; Mings, W.J. *Transactions of the American Nuclear Society (USA)*, 57: 47-48 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A transportable storage cask (TSC) would ideally be used for dry storage of spent fuel for a period of 20 to 40 yr; then it would be shipped to another location for opening and disposal of the spent fuel. The potential effects of long-term dry storage on the in-transport reliability of a TSC are being evaluated as part of the Transportable Storage Cask Technical Issue Resolution Program at Sandia National Laboratories. This program will provide a proof-of-principle demonstration of one alternative for ensuring the functional reliability of a TSC has not degraded as a result of the storage environment. Sets of test coupons of potential cask materials placed in a long-term dry storage test environment now can provide future confirmatory information on radiation, thermal, and aging effects on mechanical material properties prior to shipment of TSCs. This information would be available without destructively testing an actual cask. A long-term materials evaluation has been initiated at the Idaho National Engineering Laboratory (INEL) in conjunction with an ongoing spent-fuel storage cask demonstration program. The objective of the materials testing program is to provide demonstration baseline and operational information that can be used to help verify appropriate requirements. The Transnuclear TN-24P storage cask at INEL, which is loaded with consolidated spent fuel, will provide an actual dry storage test environment.

130 **The contribution of spent-fuel shipping cask residual contamination to the transportation source term.** Mings, W.J.; Pasupathi, V.; Sandoval, R.P.; Jordan, H.; Einziger, R.E. *Transactions of the American Nuclear Society (USA),* 57: 48-50 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The source term contribution from crud associated with spent-fuel assemblies was estimated. It was found that the population of spent-fuel rods as a function of adhered crud activity is bimodally distributed. Using the activity density mode corresponding to the majority of the fuel rod population for both BWR and PWR fuel rods transported in an NLI-1/2 cask gives a total adhered crud activity of ≈2.2 Ci for a typical BWR two-assembly shipment and 7 Ci for a typical PWR one-assembly shipment. These values are generally much larger than those found for residual contamination. It is important to note, however, that data on inventories of crud are much more extensive than those for residual contamination. If the same particle size distribution is assumed for crud and cask residual contaminants, then aerosol attenuation for the two will be the same, and residual cask contamination will, therefore, generally be the less important source term contributor.

131 **Status of spent-fuel transportation system development.** Chapman, R.L.; Hall, I.K. *Transactions of the American Nuclear Society (USA),* 57: 50-51 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The purpose of the Cask Systems Development Program (CSDP) is to develop a variety of cask systems that can safely and economically be used to move commercial spent fuel and high-level waste from the generator to the federal repository or monitored retrievable storage facility. There are four initiatives to the CSDP, but only the first, from reactor casks, has been activated. This paper is limited to a discussion of the status of that initiative. Schedule objectives for the CSDP include development of spent-fuel cask systems by 1995 to support the Office of Civilian Radioactive Waste Management shipments of spent fuel from utilities beginning in the late 1990s. The US Department of Energy (DOE)-Idaho, with the support of EG & G Idaho, Inc., Sandia National Laboratories, and selected cask development contractors, has been assigned the responsibility for developing a family of cask systems that are suitable for the task. Initially, four categories of spent-fuel casks were to be developed. They are legal-weight truck (LWT) casks, overweight truck (OWT) casks, rail/barge (R/B) casks, and dual purpose (DP) (storage/transport) casks. For a variety of reasons, OWT and DP cask development activities have been deferred. Program goals include developing a family of casks that will permit minimizing total system life cycle costs, ensure safety to the general public and to occupational workers, and attain public confidence in the transportation system.

132 **Minimum-weight highway transporters for nuclear spent-fuel casks.** Hoess, J.A.; Drago, V.J.; Peterson, R.W. *Transactions of the American Nuclear Society (USA),* 57: 51-53 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This study is one of four that represent a total systems approach to developing highway transporter and cask specifications for the transportation of nuclear spent fuel within the US Department of Energy (DOE) Office of Civilian Radioactive Waste Management Program. In addition to this study, which identifies a range of transporter characteristics and weight options, studies will be conducted to develop cask capacity versus gross weight options, estimates of operational factors, and life cycle costs and exposure estimates. The results of these four studies will be synthesized to support a decision on the final selection of cask-transporter systems specifications. The decision will be based on DOE policy and program objectives and made in the context of current regulations. This study identifies options for commercially available heavy-duty on-highway tractors and trailers for transporting proposed future loaded nuclear spent-fuel casks. Loaded cask weights of 56,000- and 80,000-lb were selected as reference design points to facilitate the collection, examination, and presentation of study information. Emphasis was placed on identifying minimum-weight tractors and trailers capable of safely and reliably transporting a 56,000-lb cask without exceeding a gross combination weight (GCW) of 80,000 lb, and an 80,000-lb cask without exceeding a GCW of 110,000 lb. No specific safety or reliability studies were conducted.

0510 Marketing, Economics, and By-products

133 **Risks versus savings in the international spot market.** Karalus, J.L. *Transactions of the American Nuclear Society (USA),* 56: 93 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

This paper describes the international spot market, some of its risks and difficulties, and examples of the ways potential savings can be realized. Fuel cycle goods and services available in the international spot market include uranium as U_3O_8, natural UF_6, enriched UF_6, conversion services, and enriching services.

0520 Waste Management

Refer also to citation(s) 49, 117, 119, 127, 471, 474, 487, 490, 500, 544, 872, 958, 967, 1345

134 (BNWL-CC–2188) **Analysis of samples from the Purex vessel vent silver reactor.** du Plessis, L.A.; Sutter, S.L. Battelle Pacific Northwest Lab., Richland, WA (USA). 11 Jun 1969. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90001661. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The process vessel off-gases originating in nuclear fuel reprocessing plants are routinely treated to remove excessive radionuclide contents. In the Purex Plant, at Hanford, one of the treatment steps reduces the concentration of ^{131}I by passing the gas through a heated bed of $AgNO_3$ coated Berl saddles. The silver reactors for the dissolving vessel off-gas system have proved to be effective traps for iodine under ordinary operating conditions. However, there has been concern about the efficiency of the vessel vent silver reactor, which operates at the comparatively low temperature of 160°C (vs. 190° in the dissolver cells), takes a larger off-gas load than the dissolver reactors, and has a lower concentration of iodine. It has also been suspected that organic iodides, which could be at higher concentration in the vent system, might not be as efficiently trapped in the reactor as inorganic compounds of iodine. Organic iodides have been qualitatively identified in the stack gases of the Hanford and Savannah River Purex plants. These investigations did not include quantitative estimation of the organic iodides. In the present study, the vessel vent off-gas and the material in a spent vessel vent silver reactor were analyzed qualitatively and quantitatively. Two gas sampling devices were used, a cold trap and an activated charcoal adsorber. The purpose of these analyses

was to ascertain whether the reactor is trapping iodine, and to discover reasons for failure to trap it. 8 refs., 5 figs., 10 tabs.

135 (BNWL-CC-2378) **Some observations concerning the chemistry of the Purex vessel vent silver reactor.** du Plessis, L.A. Battelle Pacific Northwest Lab., Richland, WA (USA). 16 Jan 1970. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90001660. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The process vessel off-gases from nuclear fuel reprocessing plants are routinely treated to remove excessive radionuclides. In the Purex plant at Hanford, one of the treatment steps reduces the concentration of ^{131}I by passing the gas through a heated bed of Berl saddles coated with silver nitrate. This piece of equipment is known as a silver reactor. The silver reactors in the dissolving vessel off-gas system have proved to be effective traps for iodine under ordinary operating conditions. Organic iodides, could be present at higher concentration in the vessel vent than in the dissolver off-gas and might not be as efficiently trapped in the reactor as inorganic compounds of iodine. Organic iodides have been identified in the stack gases of the Hanford and Savannah River Purex plants. The present report is the third on the chemistry of the vessel vent silver reactor. As the work described in these documents has been discontinued, the contents of all three reports are summarized and discussed in the concluding section of this report. The results obtained hitherto are by no means complete, and the concluding section contains suggestions for the direction of further work, when the chemical study of the silver reactors can be resumed. 5 refs., 1 fig., 4 tabs.

136 (CONF-860905–Vol.2, pp. 1594-1603) **Control of clarity and radioactivity in fuel storage basin water.** Rhodes, D.W. (Westinghouse Idaho Nuclear Co., Idaho Falls (USA)); Mondok, E.P. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. DOE Contract AC07-84ID12435. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY (USA); 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 2.* Order Number DE88015082. Available from NTIS, PC A99/MF A01.

The storage of spent reactor fuel underwater in fuel storage basins provides cooling and shielding, but the water must be clear so that the fuel can be identified, unloaded, transferred to storage, and later removed for processing. The concentration of radionuclides in the water must be kept low to facilitate decontamination of the casks and to minimize exposure of personnel to radiation. Techniques used to leak-test the fuel, remove suspended particulate matter, and remove dissolved solids and radionuclides from the basin water are described. The effects of using these techniques on the quality of the basin water at the ICPP is also discussed.

137 (CONF-860905–Vol.2, pp. 1915-1923) **Economic analysis of projected high-level waste immobilization operations at the Savannah River Plant.** McDonell, W.R. (E. I. du Pont de Nemours and Co., Aiken, SC (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY (USA); 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 2.* Order Number DE88015082. Available from NTIS, PC A99/MF A01.

A model has been defined and input established for the projection of operating costs for processing high-level radioactive wastes to solid form in the Defense Waste Processing Facility (DWPF). The projected costs (expressed in categories designated essential materials, utilities, manpower, and overhead) determine economic incentives for process optimization in both near-term DWPF operations and long-term waste generation at the Savannah River Plant (SRP). The process model, though not predictive of specific modes of DWPF operation, permits evaluation of incremental costs in circumstances involving large backlogs of accumulated waste.

138 (CONF-890488–12) **The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater.** Ebert, W.L.; Bates, J.K.; Abrajano, T.A. Jr.; Gerding, T.J. Argonne National Lab., IL (USA). 1989. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 4. international symposium on ceramics in nuclear waste management; Indianapolis, IN (USA); 23-27 Apr 1989. Order Number DE90002257. Available from NTIS, PC A03/MF A01; OSTI; INIS.

Static leaching experiments have been performed to determine the influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater at 90°C. Both the leachates and the reacted glass monoliths were analyzed to characterize the reaction. Radiation was seen to acidify the leachates, but the high bicarbonate content of the groundwater prevented the pH values from dropping below 6.4. The glass reaction tended to raise the pH. Glasses based on SRL 165 black frit and PNL 76-68 glass compositions were leached. The SRL 165 type glasses were quite durable (as measured by the elemental mass loss after constant reaction times) and were unaffected by radiation. The PNL 76-68 glasses were much less durable, with the durability decreasing (after constant reaction times) as the exposure rate was increased. The primary effect of radiation is a lowering of the leachate pH which then affects the glass leaching rate. 9 refs., 5 figs.

139 (CONF-890488–13) **Analytical electron microscopy of leached nuclear waste glasses.** Abrajano, T.A. Jr.; Bates, J.K.; Bradley, J.P. Argonne National Lab., IL (USA). 1989. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-31109-ENG-38. From 4. international symposium on ceramics in nuclear waste management; Indianapolis, IN (USA); 23-27 Apr 1989. Order Number DE90002254. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Preliminary results of an analytical electron microscopic study of alteration layers on SRL 131-based glasses are presented. The reacted surfaces consist of multiple reaction layers of systematically varying compositions and structures. The innermost layer adjacent to the fresh glass is depleted in mobile elements (e.g., alkali metals and B), but otherwise is compositionally similar to the fresh glass. Numerous crystalline and amorphous phases were observed in the alteration layers including clays (smectite- and serpentine-kaolinite types), manganese oxyhydroxides, iron oxides and hydroxides, and titanium oxide. Both the abundance and degree of ordering of the crystalline phases increased with distance from the fresh glass. Only the outermost secondary phases appear to have clearly precipitated from the leaching solution. Evidence indicates that most of the secondary phases present within the layers nucleated within the residual layers. These results, together with results of other surface and solution analyses, are examined in relation to the mechanisms of alteration layer formation. Implications of the study to the modeling of waste glass dissolution are also discussed. 10 refs., 15 figs.

140 (CONF-891020–1) **Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater.** Hall, R.; Brown, C.H.; Robinson, S.M. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual conference and exhibition of the Water Pollution Control Federation; San Francisco, CA (USA); 15-19 Oct 1989. Order Number DE90001641. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A mobile pilot-scale continuous countercurrent ion exchange (CCIX) system is being operated at the Oak Ridge National Laboratory (ORNL) for the treatment of wastewaters that contain predominantly calcium, sodium, and magnesium bicarbonates and are slightly contaminated with ^{90}Sr and ^{137}Cs radioisotopes. A demonstration study is being conducted to evaluate the steady state performance and feasibility of a pilot-scale CCIX column for the selective removal of strontium from the wastewater. Initial test results show that the process sufficiently removes strontium from the water while significantly reducing the volume of secondary waste generation. This process has the potential for effective use in many diverse applications. However, it has not been frequently utilized by industries to date. This study shows that the CCIX process could offer an economical alternative for decontamination of wastewaters containing trace amounts of contaminants prior to discharge into the environment. 7 refs., 3 figs., 2 tabs.

141 (CONF-891103–21) **The LAW [Library to Analyze Waste] library: A multigroup cross section library for use in radioactive waste analysis calculations.** Greene, N.M.; Parks, C.V.; Arwood, J.W. Oak Ridge National Lab., TN (USA). [1989]. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89015873. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The 238 group LAW library is a new multigroup library based on ENDF/B-V data. It contains data for 302 materials and will be distributed by the Radiation Shielding Information Center, located at Oak Ridge National Laboratory. It was generated for use in neutronics calculations required in radioactive waste analyses, though it has equal utility in any study requiring multigroup neutron cross sections. 16 refs., 3 tabs.

142 (DOE/CH/10378–4) **Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0.** Osnes, J.D.; Ratigan, J.L.; Loken, M.C.; Parrish, D.K. RE/SPEC, Inc., Rapid City, SD (USA). 29 Sep 1989. 606p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC02-89CH10378;AC02-83CH10140. (RSI–0268). Order Number DE90002349. Available from NTIS, PC A99/MF A01; OSTI; INIS; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

SPECTROM-55 is a finite element computer program for analyses of coupled heat and fluid transfer through fully saturated porous media. The code is part of the SPECTROM (Special Purpose Engineering Codes for Thermal/ROck Mechanics) series of special purpose finite element programs, that address the many unique rock mechanics problems resulting from storage of radioactive waste in geologic formations. This document presents the theoretical basis for the mathematical model, the finite element formulation of the problem, and a description of the input data for the program along with details about program support and continuing documentation. The program is especially suited for analyses of the regional hydrogeology in the vicinity of a heat-generating nuclear waste repository. These applications typically involved forced and free convection in a ground-water flow system. The program provides transient or steady-state temperatures, pressures, and fluid velocities resulting from the application of a variety of initial and boundary conditions to bodies with complicated shapes. The boundary conditions include constant heat and fluid fluxes, convective heat transfer, constant temperature, and constant pressure. Initial temperatures and pressures can be specified. Composite systems of anisotropic materials, such as geologic strata, can be defined in either planar or axisymmetric configurations. Constant or varying volumetric heat generation, such as decaying heat generation from radioactive waste, can be specified.

143 (DOE/NE–0097) **Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1988: Report to Congress in Response to Public Law 99-240.** USDOE Assistant Secretary for Nuclear Energy, Washington, DC (USA). Jun 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. Order Number DE90000955. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This is the third report submitted to Congress under Public Law 99-240, "The Low-Level Radioactive Waste Policy Amendments Act of 1985" (the Act). This section of the Act requires the Department of Energy to summarize the annual expenditures made by states and compacts of funds disbursed from the Department's Surcharge Escrow Account, and to assess the compliance of these expenditures with the specified limitations. This report covers expenditures made during calendar year 1988 from funds disbursed to states and compacts following the July 1, 1986, and January 1, 1988, milestones. The next milestone in the Act is January 1, 1990, following which the accumulated surcharge deposits in the Department's Surcharge Escrow Account will again be disbursed. The Act authorizes states with operating low-level radioactive waste disposal sites (sited states) to collect surcharges on disposal of waste from generators located in compact regions currently without disposal sites (non-sited compacts) and in states that do not have sites and that are not members of compacts (nonmember states). The Act requires the sited states to make a monthly deposit to the Department of Energy's Surcharge Escrow Account of 25 percent of the surcharges they collect. Following each milestone date, the Department is required to disburse these funds, with accrued interest, back to those non-sited compacts and nonmember states found in compliance with the milestone requirements for new disposal site development. 4 tabs.

144 (DOE/OR/21864–2) **St. Charles county well field monitoring project: Quarterly report, July, August and September 1989.** Remington, S.M. Saint Charles County Water Dept., St. Charles, MO (USA). 1989. 79p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FG05-89OR21864. Order Number DE90001932. Available from NTIS, PC A05/MF A01 - OSTI.

The monthly sampling took place on September 19, 1989. I sampled well number RMW-2. Results from the July 12, 1989 samplings were received from MetaTrace. They are appended. No significant changes were noted on any of the analyses. Results from analyses by the Department of Energy were received by me for June and July 1989. I have appended all of the results in addition to letters from the Department of Energy and copies of letters to them. All are self explanatory. Their July 1989 conclusions confirm the interpretation of the June data which indicated that the St. Charles County wellfield is not contaminated with nitroaromatic compounds, but that indications of contamination were introduced into the samples via laboratory or field procedures. Quarterly sampling will take place on October 18, 1989. The decision to change the sampling program will be made next month during a meeting to be held between all of the interested agencies. I stated in may last report that no sampling would be done in October, but since the meeting was delayed one month it was decided to go ahead with the quarterly sampling in October, 1989.

145 (DOE/RL–88-27-Add.1) **Grout treatment facility dangerous waste permit application: Drawings: Addendum 1.** Department of Energy, Richland, WA (USA). Richland Operations Office. Sep 1989. 186p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90002096. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This document contains engineering drawings for a waste treatment plant to be located on the Hanford Reservation.

146 (DOE/RL–88-27-Suppl.1) **Grout Treatment Facility dangerous waste permit application: Engineering reports: Supplement 1.** USDOE Richland Operations Office, WA (USA). Sep 1989. 912p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90002099. Available from NTIS, PC A99/MF A01 - OSTI.

This supplement contains engineering reports that support information provided in the other volumes of this report. (TEM)

147 (DOE/RL–89-13) **Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989.** Westinghouse Hanford Co., Richland, WA (USA); USDOE Richland Operations Office, WA (USA). Aug 1989. 78p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90001126. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This is the first quarterly report for the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) that was signed by the US Department of Energy (DOE), the US Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). The Tri-Party Agreement sets the plan and schedule for cleanup of nuclear weapons wastes at Hanford. This report covers progress for the quarter ending June 30, 1989. Progress reports will be issued every 3 months. The Hanford Site cleanup is proceeding on schedule. All key initial tasks were completed ahead of schedule, but some other tasks are behind the original schedule because of unforeseen technical and regulatory problems, or because the original schedule was inappropriate. However, none of the delayed tasks jeopardize reaching key milestones. The 1,377 waste units that have been identified at the Hanford Site are located within 74 operable units. To protect the public and the environment, some of these waste units will need to be cleaned up

and the wastes disposed of in an acceptable and permanent manner. Some of that disposal will be on the Hanford Site. Other wastes will be retrieved, stabilized, and transported to other disposal sites that are being developed by the Federal Government. 18 refs., 5 figs., 17 tabs.

148 (EGG-M–88389) **Results of field testing of waste forms using lysimeters.** McConnell, J.W.; Rogers, R.D. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 19p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-890207–36: Waste management '89, Tucson, AZ (USA), 26 Feb - 2 mar 1989). Order Number DE90002147. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The TMI-2 EPICOR-II Resin/Liner Low-Level Waste Data Base Development Program funded by the US Nuclear Regulatory Commission (USNRC) is obtaining information on performance of radioactive waste in a disposal environment. Waste forms fabricated using ion exchange resins from EPICOR-II prefilters employed in the cleanup of the Three Mile Island Nuclear Power Station are being tested to: (a) develop a low-level waste data base, and (b) obtain information on survivability of waste forms in a disposal environment. This paper updates field testing of those waste forms during FY-1988, presents results of waste form leach testing, and compares those results to the releases of radionuclides from these lysimeter waste forms. 16 refs., 12 figs., 3 tabs.

149 (EGG-M–88435) **Lead management at the INEL [Idaho National Engineering Laboratory].** Davis, M.V.; Larsen, M.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880839–16: 10. annual DOE low-level waste management conference, Denver, CO (USA), 30 Aug - 1 sep 1988). Order Number DE90002033. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Lead at the Idaho National Engineering Laboratory (INEL) is predominantly used for radiation shielding. Lead is a hazardous material. When is becomes radioactively contaminated and can no longer be used as shielding, it becomes a mixed hazardous/radioactive waste. It is then subject to Environmental Protection Agency (EPA) regulations. These regulations require that lead be treated prior to disposal. There is no treatment process that will render lead nonhazardous nor is there a disposal site that will accept lead as a mixed waste. Decontamination of lead is the only alternative. Therefore, DOE-ID has initiated a lead management program to minimize the amount of lead waste generated at the INEL and to decontaminate existing inventories of contaminated lead. This program is being implemented in three phases. In the first phase, directives were issued which discontinued the disposal of lead in low level waste packages sent to the disposal site. The second phase is designed to manage the use of lead. The third phase will be to clean up existing lead problems. 3 figs., 2 tabs.

150 (GSF–15/88) **Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III.** Klotz, D.; Lang, H.; Moser, H. Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie; Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). 1988. 99p. (In German). Order Number DE90717905. Available from NTIS (US Sales Only), PC A05/MF A01.

The studies were mainly concerned with investigations of the sorption of radioactive Cs and C using three sandy and three cohesive samples with the help of batch and continuous-flow column tests. The results show that the sorption behaviour of Cs-134 can be described with the help of an exponential isotherm. Differences in sorption and desorption behaviour as well as the dependence of the results on the volume/mass ratios applied in the batch tests are explained in this way. Accordingly, the transportation of the Cs in continuous-column tests reveals a delay increase proportional to an increase of path length. The tests using C-14 are strongly inhibited by a rapid exchange of the applied C-14 labelled carbonate ions with the CO_2 of the supernatant gaseous phase. This notwithstanding, it could be shown that the carbonate ions are only slightly delayed, and that substantial quantities of the radioactive carbon applied are held back with the examined sediments. (orig./HP).

151 (LA-UR–89-2017) **A delayed-neutron monitor for a liquid-waste stream with high gamma-ray intensity.** Rinard, P.M.; Crane, T.W.; Van Lyssel, T.; Kroncke, K.M.; Schneider, C.M.; Bourret, S.C. Los Alamos National Lab., NM (USA). 1989. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891118–1: International meeting on nuclear criticality safety margins, San Francisco, CA (USA), 26 Nov - 1 dec 1989). Order Number DE89014317. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An instrument has been built to monitor the uranium concentration in a liquid-waste stream to avoid a criticality accident in a downstream holding tank. The measurement technique is based on the production and counting of delayed neutrons using the "shuffler" process because the waste contains enough fission products to produce a gamma-ray dose rate of 10 R/h on the surface of the assay tank. The design goal was a sensitivity of 0.034 g/L (1σ = 10%) in 100 s as the stream flows at 80 L/h through the assay chamber. The instrument is to run unattended for at least three months; during this time it it to transmit assay results to the plant computer and generate warnings and alarms when necessary.

152 (LA-UR–89-2032) **Safeguards issues relevant to geologic disposal of spent nuclear fuels.** Pillay, K.K.S. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891103–9: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014313. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In civilian nuclear fuel cycles, the time between removal of spent nuclear fuels from reactors and the final stages of nuclear waste disposal spans several decades. Safeguarding nuclear materials contained in spent fuels during this period varies with (1) storage modes, (2) packaging and transportation requirements, and (3) treatment of spent fuel for consolidation or recovery of fissile elements. This paper considers some possible diversion scenarios of spent nuclear fuels and identifies actions necessary to evaluate the needs of a comprehensive safeguards system to assure both domestic and international safeguards. 4 refs.

153 (LA-UR–89-2124) **Neutron dieaway methods for criticality safety measurements of fissile waste.** Coop, K.L. Los Alamos National Lab., NM (USA). [1989]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891103–7: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014225. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The differential dieaway technique (DDT), which uses a pulsed neutron source to interrogate containers of fissile materials with thermal neutrons, is reviewed. This method is widely used for certifying transuranic nuclear wastes for eventual emplacement at the Waste Isolation Pilot Plant. For purposes of criticality safety, an upper limit of 200 g of fissile material is permitted in a 55-gal waste drum. Problems involving waste-matrix effects and self-shielding may severely limit the accuracy of the DDT measurement. A dieaway method that uses both thermal and epithermal neutron interrogation, which has the potential for reducing these problems, is being developed. Recent experimental and calculational results for this development are described. 14 refs., 7 figs., 1 tab.

154 (LA-UR–89-3116) **Experiences of fitting isotherms to data from batch sorption experiments for radionuclides on tuffs.** Polzer, W.L.; Fuentes, H.R. Los Alamos National Lab., NM (USA). Nov 1989. 22p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-891120–2: Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Monterey, CA (USA), 6-10 Nov 1989). Order Number DE90001830. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Laboratory experiments have been performed on the sorption of radionuclides on tuff as site characterization information for the Yucca Mountain Project. This paper presents general observations on the results of curve-fitting of sorption data by isotherm equations and the effects of experimental variables on their regressional analysis. Observations are specific to the effectiveness and problems associated with fitting isotherms, the calculation and value of

isotherm parameters, and the significance of experimental variables such as replication, particle size, mode of sorption, and mineralogy. These observations are important in the design of laboratory experiments to ensure that collected data are adequate for effectively characterizing sorption of radionuclides on tuffs or other materials. 13 refs., 2 figs., 4 tabs.

155 (LA-UR–89-3210) **Sorption of radionuclides on Yucca Mountain tuffs.** Meijaer, A.; Triay, I.; Knight, S.; Cisneros, M. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-890928–9: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90000198. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A substantial database of sorption coefficients for important radionuclides on Yucca Mountain tuffs has been obtained by Los Alamos National Laboratory over the past ten years. Current sorption studies are focussed on validation questions and augmentation of the existing database. Validation questions concern the effects of the use of crushed instead of solid rock samples in the batch experiments, the use of oversaturated stock solutions, and variations in water/rock ratios. Sorption mechanisms are also being investigated. Database augmentation activities include determination of sorption coefficients for elements with low sorption potential, sorption on psuedocolloids, sorption on fracture lining minerals, and sorption kinetics. Sorption can provide an important barrier to the potential migration of radionuclides from the proposed repository within Yucca Mountain to the accessible environment. In order to quantify this barrier, sorption coefficients appropriate for the Yucca Mountain groundwater system must be obtained for each of the important radionuclides in nuclear waste. Los Alamos National Laboratories has conducted numerous batch (crushed-rock) sorption experiments over the past ten years to develop a sorption coefficient database for the Yucca Mountain site. In the present site characterization phase, the main goals of the sorption test program will be to validate critical sorption coefficients and to augment the existing database where important data are lacking. 11 refs., 1 fig., 3 tabs.

156 (LBL–27428) **Isotopic effects on solubility-limited mass transfer.** Isayama, Y.; Chambre, P.L.; Pigford, T.H.; Lee, W.W.L. Lawrence Berkeley Lab., CA (USA). Jun 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891103–40: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989; UCB-NE–4157). Order Number DE90002330. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In our previous theoretical analyses, solubility-limited mass transfer from waste solids applies if a species is at a constant elemental concentration in liquid at the waste surface. For an element with isotopes that decay appreciably during the time of interest, a solubility boundary condition results in a time-dependent boundary concentration of each isotope. Here we present mass-transfer equations that include the effects of isotopic decay boundary conditions. 9 refs., 1 fig.

157 (NUKEM-FuE–88019) **Treatment of tritium from liquid and solid wastes for the purpose of recycling (input to an enrichment plant). Final report.** Luthardt, G. Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Nov 1988. 29p. (In German). Contract BMFT KWA 5508 3. Order Number DE90717906. Available from NTIS (US Sales Only), PC A03/MF A01.

The present report is concerned with the planning, design and cold, i.e. inactive, operation of a plant for the treatment of tritiated wastes. The tritium is intended to be recovered together with the other hydrogen isotopes preferably from highly tritiated liquid and solid wastes; this is to be done in a way that permits the feeding of the tritium into an isotope separation plant. Such a method has two advantages: firstly, tritium, which is increasingly becoming more popular (e.g. for fusion research), is recycled, so that its reproduction, which would otherwise be necessary, can be reduced accordingly; secondly, the quantity of tritium to be stored at high costs either temporarily or ultimately - after the Federal repository has been set into operation - is decreased accordingly. A suitable plant was conceived consisting of 1. an extraction section in which the hydrogen isotopes are completely removed by heating; 2. a purification section in which impurities such as O_2, H_2O, carbon oxides, hydrocarbons, i.a. are removed from the extracted gas. The purification should be effected with uranium, Zr-Al alloys or by means of permeation of the hydrogen isotopes through a Pd-Ag diaphragm; 3. ionization chambers for measuring the concentration of tritium in the plant; 4. a mass spectrometer for analysing the gaseous mixture; 5. a storage system for the hydrogen isotopes purified on the basis of uranium, with a storage capacity of up to $9{,}25 \times 10^{14}$ Bq (25 kCi) with a very efficient backup safety. (orig./RB).

158 (NUREG/BR–0121) **Regulating the disposal of low-level radioactive waste: A guide to the Nuclear Regulatory Commission's 10 CFR part 61.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards. Aug 1989. 36p. Sponsored by Nuclear Regulatory Commission. Available from OSTI; INIS; Division of Low-Level Waste Management and Decommissioning, Mail Stop 5E4, Office of Nuclear Material Safety and Safeguards, Washington, DC 20555.

This document summarizes the regulations contained in the Nuclear Regulatory Commission's principal guide to low-level radioactive waste disposal. In addition to brief comments concerning the statutes, a section is devoted to answering the most frequently asked questions. This is a non-technical document. (TM)

159 (NUREG/CP–0098-Vol.1, pp. 498-510) **Upgrade of the radioactive air emission systems at Oak Ridge National Laboratory.** Youngblood, E.L. (Martin Marietta Energy Systems, Oak Ridge, TN (USA)); du Mont, S.P.; Helms, R.E. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Harvard Univ., Boston, MA (USA). Harvard Air Cleaning Lab. May 1989. DOE Contract AC05-84OR21400. (CONF-880815–Vol.1: 20. DOE/NRC nuclear air cleaning conference, Boston, MA (USA), 22-25 Aug 1988). In *Proceedings of the 20th DOE/NRC nuclear air cleaning conference. Sessions 1–5.* Order Number DE89014647. Available from NTIS, PC A99/MF A01 - I.

A program is under way to upgrade the radioactive air emission systems at Oak Ridge National Laboratory to ensure long-term system reliability and compliance with environmental regulations. The primary sources of radioactive air emissions are cell ventilation and process off-gas from reactor operations and isotope production, analytical facilities, and laboratories used for research and development. A major portion of the radioactive air emissions is discharged through seven separate ventilation stacks, several of which have been in operation for over 25 years. Improvements that are being addressed by the program include: (a) replacement of deteriorated ventilation ducts, filter systems, and fans and motors; (b) upgrade of sampling and monitoring systems to provide isokinetic sampling and improved analysis and data management; and (c) reduction in emissions and potential radiation exposure associated with the air emission systems. To ensure that all emission sources have been identified and evaluated, a comprehensive stack-and-vent survey was performed and recorded in a computer data base. Studies have been performed to determine the cost/benefit of further reduction in tritium emissions, to evaluate the methods of repair of the underground concrete ventilation ducts, and to evaluate the condition of fans and motors by vibrational analysis. Thus far, an excess of $10 million in upgrades have been added to the existing radioactive air-handling systems and another $6 million in improvements are projected over the next 3 years. Example projects to upgrade a stack ventilation system and a stack monitoring system are described. Studies for determining future upgrade requirements are discussed.

160 (NUREG/CR–4735-Vol.5) **Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988.** Interrante, C.; Escalante, E.; Fraker, A.; Plante, E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; National Inst. of Standards and Technology, Gaithersburg, MD (USA). Metallurgy Div. Oct 1989. 156p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

This report summarizes evaluations by the National Institute of Standards and Technology (NIST) of Department of Energy (DOE)

activities on waste packages designed for containment of radioactive high-level nuclear waste (HLW) for the six month period February 1988 through July 1988. Activities for the DOE Materials Characterization Center are reviewed for the period January 1988 through June 1988. A summary is given of the Yucca Mountain, Nevada disposal site activities. Short discussions relating to the reviewed publications are given and complete reviews and evaluations are included. 20 refs., 1 fig., 1 tab.

161 (NUREG/CR–5429-Vol.1) **UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Sep 1989. 215p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A10/MF A01 - GPO - OSTI.

UDEC (Universal Distinct Element Code) is a two-dimensional distinct element program written for the static and dynamic analysis of the mechanical, thermal and hydrologic behavior of jointed rock masses. This program has been applied to a wide variety of problems in civil construction, mining, nuclear waste disposal, and geologic modeling. This document presents the theoretical basis for the mathematical models, the details of solution procedures, user's manual and presentation of verification and example problems. A description of the program support and documentation methodology which is employed is also given. This document is given in three volumes: This document, Volume 1 – Description of mathematical models and numerical methods, and Volume 2 – User's manual, and Volume 3 – Verification and example problems. These three volumes are intended to satisfy the requirements and guidelines set forth in Final Technical Position and Documentation of computer Codes For High-Level Waste Management (NUREG-0856). 76 refs., 61 figs., 11 tabs.

162 (NUREG/CR–5429-Vol.3) **UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Sep 1989. 182p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A09/MF A01 - GPO - OSTI.

UDEC (Universal Distinct Element Code) is a two-dimensional distinct element program written for the static and dynamic analysis of the mechanical, thermal and hydrologic behavior of jointed rock masses. This program has been applied to a wide variety of problems in civil construction, mining, nuclear waste disposal, and geologic modeling. This document presents the theoretical basis for the mathematical models, the details of solution procedures, user's manual and presentation of verification and example problems. A description of the program support and documentation methodology which is employed is also given. This document is given in three volumes: Volume 1 — Description of Mathematical Models and Numerical Methods and Volume 2 — User's Manual. This document, Volume 3, presents verification and example problems. These three volumes are intended to satisfy the requirements and guidelines set forth in Final Technical Position and Documentation of Computer Codes for High-Level Waste Management (NUREG-0856). 26 refs., 53 figs., 18 tabs.

163 (ORNL/Sub–86-SA094/3) **The incentives and feasibility for direct measurement of spent nuclear fuel characteristics in the Federal Waste Management System.** Oak Ridge National Lab., TN (USA); Johnson (E.R.) Associates, Inc., Oakton, VA (USA). Aug 1989. 166p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. Order Number DE90001846. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

The purpose of this work is to assess the nature and extent of the need for direct measurements of spent fuel characteristics within the utility and federal portions of the waste management system, and to evaluate the capability and limitations of various measurement devices for meeting those needs. The need for direct measurement is evaluated relative to the alternative sources of the spent fuel characteristics data required for the safe and effective operation of the system. The results of this work are intended to support Federal Waste Management System (FWMS) planners by identifying the probable and potential requirements for direct measurements and for making related programmatic decisions based on the adequacy or development requirements for appropriate measurement technologies to support the needs of facility and equipment designers and operators. The designers and operators of the FWMS need to know the characteristics of the spent nuclear fuel (SNF) and related wastes that will be handled, processed, stored, transported and ultimately emplaced underground for final disposal. There are typically two basic sources of this needed information: (1) historical records of measurements made when the fuel was being fabricated or was producing energy; and (2) direct measurements made during handling prior to disposal. Historical records would include the design and fabrication records of the nuclear fuel assemblies and the subsequent utility records of reactor and core operations. 21 refs., 3 figs., 5 tabs.

164 (ORNL/Sub–88-SC924/1) **Environmental monitoring annual report for the Tumulus Disposal Demonstration Project: Fiscal year 1988.** Yager, R.E.; Craig, P.M. Environmental Consulting Engineers, Inc., Knoxville, TN (USA). Jan 1989. 77p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90001845. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The Fiscal Year 1988 Annual Report is the third in a series of semi-annual Tumulus Development Disposal Project data summary reports. The reporting schedule has been modified to correspond to the fiscal years and the subcontractor contract periods. This data summary spans the time from start of operations in June 1987 through the end of September 1988. The environmental data collected include run-off water quality and quantity, groundwater quality and levels, soil sampling and hydrometeorological data. This data is being used and analyzed here to demonstrate the environmental performance objectives for the TDDP as part of the overall performance assessment for the TDDP. Approximately one year of pre-operational data were collected prior to operations beginning on April 11, 1988. Comparisons are made between pre- and post-operational data. No significant environmental impacts have been found since operations have begun. 10 refs., 21 figs., 22 tabs.

165 (ORNL/TM–11286) **Demonstrations of technology for remediation and closure of Oak Ridge National Laboratory waste disposal sites.** Spalding, B.P.; Jacobs, G.K.; Davis, E.C. Oak Ridge National Lab., TN (USA). Sep 1989. 93p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90001854. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The environmental restoration of Oak Ridge National Laboratory (ORNL) sites, that have been contaminated by previous waste disposal operations, will require extensive remedial actions to protect human health and the environment from continuing and future releases. However, many of these waste management sites do not have obvious solutions to reduce the contamination of the environment and to provide long-term performance of contaminant measures. Many potential techniques for stabilization and closure of these contaminated sites have unanswered questions about their effectiveness, method of implementation, and costs. Few techniques have established case histories that would provide assurance for their applicability to ORNL sites. Given this present state of evolution of remedial technology, the planners of environmental restoration are faced with the problem of proceeding with the best available or established technology, which inherently assumes a large risk because long-term, performance is not assured. Considering the huge potential costs of a second future round of environmental restoration, a compelling justification can be made for closure techniques so that their effectiveness can be established before the implementation of environmental restoration projects. Such techniques under evaluation at ORNL include in situ vitrification, in situ grouting, and dynamic compaction. 22 refs., 30 figs., 18 tabs.

166 (PNL–6992) **Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988.** Eberhardt, L.E.; Cadwell, L.L.; Price, K.R.; Carlile, D.W. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 57p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90001528. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

From 1971 through 1988 at least 40 species of wildlife and 27 different types of food products were collected and analyzed for radionuclides as part of the Pacific Northwest Laboratory (PNL) Environmental Monitoring Program. This report summarizes the results of these analyses for sample types collected for all or most of the 18-year period. The objectives of this summary investigation were to identify long-term trends or significant year-to-year changes in radionuclide concentrations and, if possible, relate any observed changes in radionuclide concentrations to their sources and probable causes. Statistical techniques were employed to test for long-term trends. Conspicuous short-term changes in radionuclide concentrations were identified from inspection of the data. 30 refs., 16 figs., 4 tabs.

167 (PNL-SA–16955) **Effective sample labeling.** Reiger, J.T.; Bryce, R.W. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–4: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90001901. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ground-water samples collected by the Pacific Northwest Laboratory (PNL) for hazardous waste and radiological monitoring programs have come under strict regulatory and quality assurance requirements as a result of laws such as the Resource Conservation and Recovery Act. Before these laws were in effect, sample collection consisted mainly of filling a single plastic bottle that was then submitted for limited analysis. To comply with these laws, PNL's sample labeling system was upgraded to unsure proper handling of ground-water samples and to protect sampling personnel from exposure to ground-water contaminants and sample preservatives. Labels are printed monthly using a computer data base that contains the following sample collection information: sample identification, data and time of collection, pump and bottle type used, sample size, and special handling requirements. There is also space on the label for the sample collector to sign and date the sample. Special handling requirements are indicated by codes and/or colored dots that can be easily recognized by field personnel. 1 fig.

168 (PNL-SA–17002) **Spent fuel performance in geologic repository environments.** Bradley, D.J. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 70p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-8906231–1: Research Coordination Program meeting on the performance of solidified high-level waste forms and engineering barriers under repository conditions, Winnipeg (Canada), 5-8 Jun 1989). Order Number DE90000814. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The performance assessment of the radioactive waste package is a current topic of study in the United States to develop a geologic repository for nuclear waste isolation. The waste package is presently envisioned to consist of the waste form and its surrounding containers. This waste package is tied to specific performance objectives set forth in regulatory criteria. It is the goal of the DOE Office of Civilian Radioactive Waste Management (OCRWM) to develop the necessary information on the waste package to show that the waste package provides confidence of meeting established performance criteria. This paper will discuss the United States program directed toward managing high-level radioactive waste, with emphasis on the current effort to define the behavior of irradiated spent fuel in repository environments. Spent fuel is of particular interest since it is expected to be the primary nuclear waste form disposed in a geologic repository. Current studies are directed toward understanding the rate and nature (such as valence state, colloid form if any, solid phase controlling solubility) of radionuclide release from the spent fuel. Due to the strong interactive effect of radiation, thermal fields, and waste package components on this release, current spent fuel studies are being conducted primarily in the presence of waste package components over a wide range of potential environments. 49 refs., 19 figs., 5 tabs.

169 (RFP–4352) **In-drum vitrification of transuranium waste sludge using microwave energy.** Petersen, R.D.; Johnson, A.J. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 1989. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-891103–3: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014175. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Microwave vitrification of transuranic (TRU) waste at the Rocky Flats Nuclear Weapons Plant is being tested using actual TRU waste in a bench scale system and simulated waste in a pilot system. In 1987, bench scale testing was completed to determine the effectiveness of in drum microwave vitrification of simulated precipitation sludge. The equivalent used in the bench tests included a 6KW, 2.45 GHz microwave generator, aluminum cavity, turntable, infrared (IR) thermometer and screwfeeder. Passive chokes were added to the cavity for mounting the IR thermometer and screwfeeder.

170 (SAND–87-1246) **Results from electromagnetic surface surveys to characterize the Culebra aquifer at the WIPP [Waste Isolation Pilot Plant] site.** Bartel, L.C. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 84p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE90001884. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The hydrologic character of the aquifer contained within the Culebra Dolomite Member of the Rustler Formation is being studied. The hydrology studies suggest that permeable portions of this aquifer may be in the form of a strip(s) which cannot be described by a uniform (horizontal or radial) flow model. Electromagnetic surface geophysical surveys were conducted over an area south of the WIPP facility to provide information on aquifer boundaries, zones of high transmissivity, etc., for the 2-D and 3-D fluid flow modeling. Approximately 20 line km of controlled-source audiofrequency magnetotelluric (CSAMT) data were acquired covering an area of approximately 12.6 square km. 20 refs., 17 figs., 6 tabs.

171 (UCRL–102033) **Hydrology and radionuclide migration at the Nevada Test Site.** Buddemeier, R.W.; Finkel, R.C.; Marsh, K.V.; Ruggieri, M.R.; Rego, J.H.; Silva, R.J. Lawrence Livermore National Lab., CA (USA). Oct 1989. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891120–4: Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Monterey, CA (USA), 6-10 Nov 1989). Order Number DE90002225. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have compared the transport behavior in various environments of radionuclides originating from underground nuclear tests at the Nevada Test Site (NTS). Under saturated conditions in both alluvium and fractured volcanic rock, ^{36}Cl, ^{129}I, and ^{3}H exhibit mutually consistent and presumably conservative behavior during saturated flow. At the saturated fractured rock site, ^{99}Tc was conservative under most conditions, but was not present in samples containing high levels of iron oxyhydroxides formed in the well water. ^{125}Sb and ^{137}Cs transport was observed in fracture flow, but concentrations of Sb were somewhat attenuated and Cs was strongly retarded. Total activity levels of these nonconservative nuclides were not affected by the particulate phenomena that reduced ^{99}Tc levels. Studies of transport in unsaturated alluvium showed that neither ^{36}Cl nor ^{129}I were conservative relative to tritium. Observations of the relative transport behavior of the radionuclides as functions of both time and distance permit deductions about the nature of their source terms. 11 refs., 9 figs.

172 (USGS-OFR–89-359) **Preliminary description of quaternary and late pliocene surficial deposits at Yucca Mountain and vicinity, Nye County, Nevada.** Hoover, D.L. Colorado Geological Survey, Denver, CO (USA). 1989. 48p. Sponsored by U.S. Geological Survey. DOE Contract AI08-78ET44802. Order Number DE90001382. Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS; GPO Dep.

The Yucca Mountain area, in the south-central part of the Great Basin, is in the drainage basin of the Amargosa River. The mountain consists of several fault blocks of volcanic rocks that are typical of the Basin and Range province. Yucca Mountain is dissected by steep-sided valleys of consequent drainage systems that are tributary on the east side to Fortymile Wash and on the west side to an unnamed wash that drains Crater Flat. Most of the major washes

near Yucca Mountain are not integrated with the Amargosa River, but have distributary channels on the piedmont above the river. Landforms in the Yucca Mountain area include rock pediments, ballenas, alluvial pediments, alluvial fans, stream terraces, and playas. Early Holocene and older alluvial fan deposits have been smoothed by pedimentation. The semiconical shape of alluvial fans is apparent at the junction of tributaries with major washes and where washes cross fault and terrace scarps. Playas are present in the eastern and southern ends of the Amargosa Desert. 39 refs., 9 figs., 1 tab.

173 (WHC-SA–0661) **Hanford Waste Vitrification Plant remote handling application.** Swenson, L.D.; Wolfe, B.A. Westinghouse Hanford Co., Richland, WA (USA). Sep 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-891103–31: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90001256. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) Project, to be constructed on the Hanford reservation in southeastern Washington State during the 1990's, will immobilize the liquid, high-level defense waste stored there. The wastes will be retrieved from double-shell tanks and pretreated at an existing facility onsite. Pretreatment will significantly reduce the volume of wastes to be solidified in HWVP by separating the feed streams into high- and low-activity streams. The high-volume, low-activity fraction of the waste will be sent to the Hanford Grout Treatment Facility for immobilization in a cementitious form in near-surface disposal vaults. The high-activity, low-volume fraction of the waste stream will be sent to HWVP for solidification in a vitrified (borosilicate glass) waste form. The vitrified waste will ultimately be sent to the US geological repository for permanent disposal. These operations comprise the initial steps at Hanford to provide for the permanent disposal of approximately 50,000,000 gal (190,000 m^3) of high-level waste containing approximately 70,000,000 Ci of waste fission products and 70,000 Ci of transuranic (TRU) elements, including 400 kg of plutonium. An essential design requirement of HWVP is to achieve a facility which meets the radiation protection requirements of "As Low As Reasonably Achievable" (ALARA). With the emphasis on radiation protection of the plant operating staff, it is imperative that the process operations involving radioactive materials use remote handling technology to the maximum degree economically feasible. 2 figs.

174 (WHC-SA–0718) **The April 1962 criticality event in the Recuplex facility.** Brown, C.L. Westinghouse Hanford Co., Richland, WA (USA). Sep 1989. 5p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. (CONF-8909180–2: ANL conference on the prevention of significant safety-related events in the operation of US Department of Energy nuclear facilities, Richland, WA (USA), 11-14 Sep 1989). Order Number DE90001254. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

On Saturday morning, April 7, 1962, at 10:59 a.m., an accidental nuclear excursion occurred in the plutonium waste recovery facility (Recuplex) of the 234-5 building. The nuclear excursion was the first and only one to have occurred in any production facility at Hanford. This excursion did not result in any mechanical damage or spread of contamination. Three employees received overexposures to gamma and neutron radiation of 110, 43, and 19 rem, respectively. In each case, the overexposure was recognized promptly, and following medical observation and testing, the men were released to return to work.

175 (WINCO–1068) **Transport properties of radionuclides and hazardous chemical species in soils at the Idaho Chemical Processing Plant.** Del Debbio, J.A.; Thomas, T.R. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA). Oct 1989. 49p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE90001871. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Near-surface, on-site disposal is being evaluated as a no-action alternative for future environmental documentation for high-level radioactive waste (HLW) stored at the Idaho Chemical Processing Plant (ICPP). As part of this evaluation, a three-dimensional code, TRACR3D, is being used to model potential transport of radioactive and hazardous species from the calcine to the Snake River Plain Aquifer under various water-contact scenarios. Laboratory studies have been completed to provide measured transport parameters for selected radionuclides and hazardous chemical species to allow for the development of accurate solute transport models. Distribution coefficients (Kd) for cadmium, mercury, selenium (as $SeO_3^=$), and strontium were measured using batch equilibrium sorption methods. Measured distribution coefficients for the sorption of cadmium and strontium on sedimentary materials were very nearly independent of initial metal concentrations in contrast to mercury and selenium whose Kd values were highly dependent on initial metal concentrations. Distribution coefficient ranges in units of mL/g were as follows: alluvium, Cd 2864-4891, Hg 236-1912, Se 5.8-63, Sr 35-52; interbed sediment, Cd 8622-10,115, Hg 72-673, Se 4.9-17, Sr 110-186; basalt, Cd 785-2319, Hg 9.2-87, Se 0.29-3.4, Sr 1.1-2.7. 22 refs., 9 figs., 8 tabs.

176 (WSRC-RP–89-511) **A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry.** Corbett, R.A.; Morrison, W.S.; Jenkins, C.F. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8911104–1: Symposium on corrosion testing and evaluation, Orlando, FL (USA), 6-7 Nov 1989). Order Number DE90001313. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The design of a hazardous waste immobilization facility at the Savannah River Site (SRS) set material requirements for both abrasion resistance and corrosion resistance in process equipment. Standard ASTM slurry wear test G75 was modified to permit evaluation and comparison of abrasive resistance of candidate materials of construction in the laboratory. However, corrosion was found to contribute significantly to overall metal loss during the testing. Consequently, the abrasive slurry used for the testing was modified by adjusting its chemistry to include appropriate corrosive species. The Miller numbers obtained in the modified G75 Miller abrasion test are described. Pilot plant observations for Type 304L austenitic stainless steel were available. These data were used to generate a "Morrison-Miller Ratio" in order to determine anticipated field abrasion properties for other alloys. Hardness for many of the alloys fell in a narrow range about Rockwell B90, but performance varied significantly in response to slurry chemistry. This effect if synergistic may often be overlooked in the selection process, and it needs to be addressed. Some pilot plant testing of other alloys is essential to confirm the calculated abrasion rates and the approach of using the Morrison-Miller ratio. 6 refs., 3 figs., 5 tabs.

177 (WSRC-RP–89-659-Rev.1) **Distributed control system-based process simulation: Revision 1.** Vargo, M.F.; Rueter, K.J. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891192–18: Annual Westinghouse computer symposium, Pittsburgh, PA (USA), 6-7 Nov 1989). Order Number DE90001311. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A Distributed Control System is being used to control the Defense Waste Processing Facility process at the Savannah River Site. Comprehensive knowledge of the Distributed Control System's structure, languages, and techniques gained during definition of the software has enabled us to extend its applications and define models of the field equipment to close the measurement/control loops. The reactive simulation that is the result of this work is realistic and flexible. As such, it provides a useful offline environment for training future site operators.

178 (WSRC-RP–89-740) **The DWPF Melter proposed heat up sequence.** Smith, M.E. Westinghouse Savannah River Co., Aiken, SC (USA). 11 Aug 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90001309. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Per the request of DWPT supervision, a proposed heatup sequence for the DWPF Melter has been documented in this report. DWPF personnel will use this report as a guide to write the detailed DWPF Melter startup plan. 6 refs.

179 (YJT–88-13) **Intraval-project test case 5: tracer tests at Finnsjoen. Predictive modelling of the radially converging experiment.** Hautojaervi, A.; Taivassalo, V. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Nov 1988. 34p. Order Number DE90606380. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A concept of varying aperture channels in a fracture plane has been worked through and applied to the Intraval project case 5 to predict tracer transport in a radially converging flow geometry. The aim of the tracer tests is to investigate the transport properties in a highly conductive rock over distances up to about 400 m. In the radially converging experiment water is pumped from one borehole and tracers are injected into three different isolated sections of a fracture zone, into the so called subzones. The subzones appear as highest local transmissivities in the three injection boreholes existing at distances of 123 m, 168 m and 179 m from the pumping hole. Mean flow times have been calculated using the reported hydrological data and the conceptual model described in this report. The tracer transport has been modelled applying a concept of linear flow velocity field across the channel width. Molecular diffusion combined to the advection in the velocity field has been taken into account in the transport calculations. The break-through as mean flux out of the whole fracture cross-section has been obtained as a function of time. A dilution factor has been evaluated from the geometrical and hydrological data and absolute break-through curves have been predicted. The real time dependence and concentrations for all of the injected tracers were not known at the time of writing of this report. The planned injection period of about nine weeks, 1500 hours, was used for most of the predictions and the injected concentrations were assumed to be 1000 ppm. For two injection sections the actual injection concentrations were known and taken into account. Calculations have been done also for short injection periods. An injection period of 1.5 h has been used in the calculations. The dilution factor has not been taken into account for these short duration injections. (Abstract Truncated)

180 **Filtration of polydispersed colloids.** Nuttall, H.E. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-880348–: American Institute of Chemical Engineers spring national meeting, New Orleans, LA (USA), 6-10 Mar 1988).

Technical Paper 11E.

In this study, the dynamic microscopic form of the population balance model is applied to the problem of polydispersed particle capture in one spatial diffusion. This mathematical modeling approach can be applied to the difficult and potentially important problem of particulate (radiocolloid) transport in the groundwater surrounding a nuclear waste disposal site. To demonstrate the population balance methodology, the equations were developed and used to investigate transport and capture of polydispersed colloids in packed columns. Modeling simulations were compared to experimental column data. The multidimensional form of the population balance equation was used to analyze the transport and capture of polydispersed colloids. A numerical model was developed to describe transport of polydispersed colloids through a one-dimensional porous region. The effects of various size distributions were investigated in terms of capture efficiency. For simulating the column data, it was found by trial and error that as part of the population balance model a linear size dependent filtration function gave a good fit to the measured colloid concentration profile. The effects of constant versus size dependent filtration coefficients were compared and the differences illustrated by the calculated colloid profile within the column. Also observed from the model calculations was the dramatically changing liquid-phase colloid-size distribution which was plotted as a function of position down the column. This modeling approach was excellent for describing and understanding microscopic filtration in porous media.

181 **Use of bioadsorbents for removing dissolved metals from dilute solutions.** Watson, J.S.; Scott, C.D. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 4C.

Certain microorganisms and other biological materials are able to absorb different metal ions, and this capability can be used to recovery metals from dilute sources or to remove trace impurities from wastewaters. Incorporation of the biosorbent into cross-linked gelatin beads permits them to be used in packed beds where high removal efficiencies can be obtained. Removal of strontium, an important contaminant in radioactive wastewaters, is a significant problem, and selected biosorbents immobilized in gel beds have been shown to have a significant affinity for strontium. Adsorption column performance and the roles of both the gel material and incorporated microorganisms are described.

182 **Nuclear waste issues. Hearings before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session on H.R. 2888 and H.R. 2967, June 11 and October 16, 1987.** Serial No. 100-92. 375p. Government Printing Office, Washington, DC (US) (1988).

This hearing examined the US DOE's proposal to build a monitored retrievable storage (MRS) facility in the State of Tennessee at the site of the Clinch River Breeder Reactor. The DOE favors building an MRS primarily as a waste packaging facility. Storage would be limited and waste would be maintained at the MRS for a brief period en route to a repository. The General Accounting Office has recommended that Congress seek more information before building. The text of two House bills is presented. H.R. 2888 would suspend certain activities of the DOE under the Nuclear Waste Policy Act of 1982 and establish a Nuclear Waste Policy Commission. H.R. 2967 would establish a Nuclear Waste Policy Review Commission and an Office of the Nuclear Waste Negotiator. Testimony was heard from 14 witnesses, representatives of the American Nuclear Energy Council, the General Accounting Office, State of Tennessee, Wisconsin Radioactive Waste Review Board, Department of Energy, MRS Study Committee, Texas Nuclear Waste Programs Office, and the Nuclear Regulator Commission.

183 **Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions.** Grambow, B.; Forsyth, R.; Werme, L.O.; Bruno, J. *Transactions of the American Nuclear Society (USA)*, 57: 43-44 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Solubility control for uranium is generally considered as a limiting factor for the release of soluble radionuclides from spent fuel. Under oxidizing conditions, the solubility-controlling uranium phase differs from the dissolving phase and a high thermodynamic driving force for UO_2 dissolution remains. Yet the experimental data show a decrease in the release rate of soluble radionuclides (i.e., ^{137}Cs, ^{90}Sr, ^{125}Sb) with time. In dynamic long-term tests, the initially high release rate of ^{90}Sr resembles the rate of uranium release with time. Since the uranium release is controlled by saturation in solution and by the frequency of solution exchange, the similarity of ^{90}Sr and uranium release means that with time uranium saturation controls the stability of the UO_2 matrix and the release of strontium. There seems to be the possibility of an agreement of the ^{90}Sr release data, structural information, and diffusion data for oxygen in UO_2. If this mechanism could be verified by comparison to other experimental data and by surface analytical techniques, the release of soluble radionuclides from spent fuel can be described as a transport process under moving boundary conditions. In the long run, a steady state should be achieved at which the flow rate and solubility-controlled release rate of uranium equals the diffusion-controlled transformation rate of the fuel matrix.

184 **LWR spent-fuel radiochemical measurements and comparison with ORIGEN2 predictions.** Blahnik, D.E.; Jenquin, U.P.; Guenther, R.J. *Transactions of the American Nuclear Society (USA)*, 57: 44-46 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Materials Characterization Center (MCC) at Pacific Northwest Laboratory is responsible for providing characterized spent fuel, designated approved testing material (ATMs) for subsequent use in the investigation of nuclear waste disposal forms by the US Department of Energy geologic repository project. The ATMs are selected to assure that test material is available that has a representative

range of characteristics important to spent-fuel behavior in a geologic repository. Burnup and fission gas release were the primary criteria for selecting the ATMs. The five spent-fuel ATMs (ATM-101, -103, -104, -105, and -106) currently being characterized by the MCC have rod average burnups ranging from 20 to 43 MWd/kg M, fission gas releases ranging from 0.2 to 11.2%, and are from both boiling water reactors and pressurized water reactors. Radiochemical analyses of the fuel included measurements of ^{148}Nd (for fuel burnup), the isotopes of uranium and plutonium, and nuclides of importance to repository performance. Cladding samples were analyzed for ^{14}C. The measured values of selected nuclides were compared with values obtained from calculations with the ORIGEN2 code that was used to predict isotopic quantities for all of the ATMS. Ratios of the ORIGEN2 calculated values to the measured values for ATM-103 and ATM-106 fuel are given.

185 **Technical evaluation of WIPP by the New Mexico environmental evaluation group.** Neill, R. *Transactions of the American Nuclear Society (USA),* 57: 56-57 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Waste Isolation Pilot Plant (WIPP) is a repository under construction in southeastern New Mexico for the disposal of 14.1 million curies of defense transuranic (TRU) waste. The US Department of Energy (DOE) plans to start storing waste in the underground facility in October 1988 for a 5-yr research and demonstration period. Since the State of New Mexico had a number of concerns in 1978 regarding the impact on health and safety of the proposed WIPP facility for disposal of radioactive waste, the DOE agreed to fund an independent technical review and evaluation of the planned repository, resulting in the creation of the Environmental Evaluation Group (EEG). This full-time multidisciplinary group has published 39 major reports to date, testified before the New Mexico Legislature and the US Congress, and has disseminated the results of analyses to DOE, the governor, the legislature, the Congress, the scientific community, and the general public. While the disposal of radioactive defense mill tailings and defense high-level wastes are both subject to US Nuclear Regulatory Commission (NRC) licensing, Congress specifically chose not to have defense TRU waste disposal licensed by the NRC. This has placed a heavy burden on EEG as the only full-time technical review agency on WIPP, but without regulatory authority.

186 **Oversight-a key ingredient in the HLW repository program.** Johnson, C.A. *Transactions of the American Nuclear Society (USA),* 57: 57 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Nuclear Waste Policy Act of 1982 (Public Lay 97-425) provides for extensive participation by affected states and Indian tribes in the federal program for storage and disposal of high-level radioactive waste and commercial spent fuel. The act, in its findings, recognizes state and public participation in the planning and development of repositories is essential in order to promote public confidence in the safety of disposal of radioactive waste and spent fuel. It is clear from this statement and the many provisions in the act for affected state and tribal participation that the Congressional intent was to mandate program oversight by the most directly affected parties. Recent actions by Congress have tended to reduce public confidence that a safe repository site can be located and developed and have eroded public opinion of the federal nuclear waste repository program in that the earlier Congressional commitment to independent oversight, contained in the 1982 act, has been notably weakened at a critical time when all parties would be best served by its strengthening.

187 **Evaporation characteristics of a reprocessing plant HLLW concentrator.** Takahashi, Masanori; Izumida, Tatsuo; Kawamura, Fumio; Yusa, Hideo. *Transactions of the American Nuclear Society (USA),* 57: 40-41 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In a high-level liquid waste (HLLW) concentrator at an industrial Purex reprocessing plant, the HLLW evaporation behavior would be rather complicated due to the large number of fission product ions present in the waste. Under a reduced-pressure evaporation process, experiments with simulated acidic solution show that the nitric acid concentration of the liquid phase initially increases from that of feed solution, i.e., 3 to ≈ 9 mole/l rather rapidly, but subsequently, instead of keeping this value, it decreases gradually and finally approaches ≈7 mol/l. In the present work, modeling was carried out in regard to vapor/liquid equilibria of nitric acid containing highly concentrated fission product nitrates, where the related reduction of nitric acid is attributed to the salt effect, which is enhanced as the fission product concentration increases. Using this model, quantitative evaluations were made in regard to the nitric acid concentration during the HLLW evaporation. The results of the simulation were examined by the experiments using a 1/200-scale pilot plant of an actual plant for HLLW concentration.

188 **The effect of liner hydraulic conductivity on disposal cell performance.** Yu, C.; Yuan, Y.C.; Chia, Y.P. *Transactions of the American Nuclear Society (USA),* 57: 41-43 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Multilayered disposal cells are frequently used for the disposal of radioactive and hazardous wastes. These disposal cells consist of materials with different permeabilities that are placed in various thicknesses at the bottom as well as in the cover of the cell. Typically, a layer of permeable material is placed above a layer with low permeability; the permeable layer functions as a drainage/leachate collection system and the low-permeability layer functions as a migration barrier/liner. This paper analyzes the effects of infiltration through unsaturated soil liners on the long-term performance of the disposal cell. Based on the results of this study, it is concluded that the long-term performance of a disposal cell is dependent on a well-designed cell cover. The design should emphasize a cap with less permeable material to prevent water from infiltrating the disposal cell. An impermeable bottom liner is effective only in the short term; however, it can eventually result in saturation of the wastes and cause the bathtub effect over the long term.

189 **The role of the Nuclear Regulatory Commission in the management of nuclear waste.** Thompson, H.L. Jr. *Transactions of the American Nuclear Society (USA),* 56: 141-142 (1988). (CONF-880601--: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

In general, the US Nuclear Regulatory Commission (NRC) is responsible for reviewing and making licensing decisions to ensure that the US Department of Energy's (DOE's) high-level waste repository is designed, constructed, and operated without unreasonable risk to public health and safety. In implementing this responsibility, however, the commission's guidance to the staff is that, in the absence of unresolved safety concerns, the NRC regulatory program will not delay the executive branch's program as set forth in the DOE project decision schedule. The NRC role for the next several years will be to develop its licensing framework and to consult with DOE on its plans. An essential ingredient in the success of both NRC's and DOE's respective missions is the need for free and open exchange of information, which will assure us that the concerns of all parties are addressed. With regard to low-level radioactive waste, the states have the lead responsibility for disposal. The NRC also provides assistance to the states and compacts on such items as regulatory programs, site characterization, and mixed waste disposal. Another of the NRC's roles is in the management of uranium mill tailings. Currently, most of the NRC's attention is focused on ensuring adequate long-term stabilization of tailings.

190 **Status of the NRC's high-level waste repository licensing program.** Bell, M.J. *Transactions of the American Nuclear Society (USA),* 56: 142-143 (1988). (CONF-880601--: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

Under the Energy Reorganization Act of 1974, as amended, and the Nuclear Waste Policy Act (NWPA) of 1982, as amended, the US Nuclear Regulatory Commission (NRC) has the responsibility of licensing the repository to be constructed and operated by the US Department of Energy (DOE) to dispose of the nation's radioactive high-level waste (HLW). At the present stage of the program, where

a single site has now been identified for detailed site characterization prior to developing an application for construction authorization, the interactions between NRC and DOE consist of informal prelicensing consultation. The NRC's prelicensing activities consist of two major components: (a) development of the body of regulations, guidance, staff positions, and review plans that document for DOE and other interested parties the requirements, procedures, and policies that NRC will apply in reviewing a license application; and (b) review of DOE's site-specific plans, data, and analyses developed as part of its site characterization program and providing comments on their adequacy to support a license application.

191 **Low-level waste management.** Knapp, M.R. *Transactions of the American Nuclear Society (USA),* 56: 144 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

This paper reviews the US Nuclear Regulatory Commission (NRC) staff views on three aspects of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act). First, the Act confirmed that states are responsible for the safe disposal of classes A, B, and C low-level waste and established both incentives and penalties to encourage the formation of regional compacts for the development of low-level disposal facilities for that purpose. Second, the Act directed the NRC, among other things, to develop the capability to review and process an application within 15 months, and third, the Act directed the NRC to develop guidance on alternative to shallow land burial.

192 **Characteristics of spent fuel and high-level waste.** Notz, K.J. (Oak Ridge National Lab., TN (USA)). *Transactions of the American Nuclear Society (USA),* 56: 178-180 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

The Office of Civilian Radioactive Waste Management (OCRWM) is responsible for the spent fuels and high-level wastes (HLWs) that will eventually be disposed of in a geologic repository. The major sources of these materials are commercial light water reactor (LWR) spent fuel and immobilized HLW. The latter includes both commercial (West Valley) and defense-related sources (Savannah River, Hanford, and Idaho). Other sources include non-LWR spent fuel and miscellaneous sources. Detailed characterizations are required for these materials. These characterizations include physical, chemical, and radiological properties; the last must take into account decay as a function of time. In addition, the present and future quantities of the various wastes must be known or projected. This information has been assembled in a characteristics data base, which provides data in four formats: hardcopy standard reports, user-oriented personal computer (PC) data bases, program-level PC data bases, and mainframe computer files. This data base is an integral part of the systems integration approach being used by OCRWM. As such, it provides a standard set of data to the various areas of responsibility within OCRWM, including storage, transportation, and geologic disposal. The data are for use in design studies, trade-off studies, and system optimization.

193 **DOE policy: Waste management QA.** Saltzman, J.; Langston, M.E. *Transactions of the American Nuclear Society (USA),* 56: 241-242 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

This paper discusses the policies of the US Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management (OCRWM) relative to quality assurance (QA), the role of QA within the context of an overall program management system, and the importance of adequate and effective QA programs to the success and credibility of the civilian radioactive waste management program. It notes some of the key actions being taken to implement OCRWM QA policies in accordance with the concepts outlined in the OCRWM directors's statement of July 13, 1987.

194 **NRC overview: Repository QA.** Kennedy, J.E. *Transactions of the American Nuclear Society (USA),* 56: 242-243 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

The US Department of Energy (DOE) is on the threshold of an extensive program for characterizing Yucca Mountain in Nevada to determine if it is a suitable site for the permanent disposal of high-level nuclear waste. Earlier this year, the DOE published the Consultation Draft Site Characterization Plan for the Nevada site, which describes in some detail the studies that need to be performed to determine if the site is acceptable. In the near future, the final site characterization plan (SCP) is expected to be issued and large-scale site characterization activities to begin. The data and analyses that will result from the execution of that plan are expected to be the primary basis for the license application to the US Nuclear Regulatory Commission (NRC). Because of the importance of these data and analyses in the assessment of the suitability of the site and in the demonstration of that suitability in the NRC licensing process, the NRC requires in 10CFR60 that site characterization be performed under a quality assurance (QA) program. The QA program is designed to provide confidence that data are valid, retrievable, and reproducible. The documentation produced by the program will form an important part of the record on which the suitability of the site is judged in licensing. In addition, because the NRC staff can review only a selected portion of the data collected, the staff will need to rely on the system of controls in the DOE QA program.

195 **Application of QA to R & D support of HLW programs.** Ryder, D.E. *Transactions of the American Nuclear Society (USA),* 56: 244-245 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

Quality has always been of primary importance in the research and development (R&D) environment. An organization's ability to attract funds for new or continued research is largely dependent on the quality of past performance. However, with the possible exceptions of peer reviews for fund allocation and the referee process prior to publication, past quality assurance (QA) activities were primarily informal good practices. This resulted in standards of acceptable practice that varied from organization to organization. The increasing complexity of R&D projects and the increasing need for project results to be upheld outside the scientific community (i.e., lawsuits and licensing hearings) are encouraging R&D organizations and their clients to adopt more formalized methods for the scientific process and to increase control over support organizations (i.e., suppliers and subcontractors). This has become especially true for R&D organizations involved in the high-level (HLW) projects for a number of years. The PNL began to implement QA program requirements within a few HLW repository preliminary studies in 1978. In 1985, PNL developed a comprehensive QA program for R&D activities in support of two of the proposed repository projects. This QA program was developed by the PNL QA department with a significant amount of support assistance and guidance from PNL upper management, the Basalt Waste Isolation Project (BWIP), and the Salt Repository Program Office (SPRO). The QA program has been revised to add a three-level feature and is currently being implemented on projects sponsored by the Office of Geologic Repositories (DOE/OGR), Repository Technology Program (DOE-CH), Nevada Nuclear Waste Storage Investigation (NNWSI) Project, and other HLW projects.

196 **Correlation between composition effects on glass durability and the structural role of the constituent oxides.** Feng, X. (Catholic Univ. of America, Washington, DC (USA). Vitreous State Lab.); Pegg, I.L.; Barkatt, A.; Macedo, P.B.; Cucinell, S.J.; Lai, S. *Nuclear Technology (USA),* 85(3): 334-345 (Jun 1989).

In this article the effects on durability of composition variations in West Valley Nuclear Services Company preliminary waste glass composition WV205 are discussed. MCC-3 results at times from 7 to 180 days are presented for 50 glass compositions. The results are suggestive of a large plateau region where durability is good and weakly dependent on composition, adjoining a region in which durability is a much steeper function of composition. The same effect is observed when the redox state of the iron, which comprises ~12wt% of the glass, is varied. The general trends are discussed in terms of the structural roles of the components. The effects of the alkalies and alkaline earths correlate quite well with the field strengths of these ions.

197 **Lead iron phosphate glass as a containment medium for disposal of high-level nuclear waste.** Boatner, L.A.; Sales, B.C. To Dept. of Energy, Washington, DC. USA Patent 4,847,008.

11 Jul 1989. Filed date 23 May 1986. 12p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes lead-iron phosphate glasses containing a high level of Fe_2O_3 for use as a storage medium for high-level radioactive nuclear waste. By combining lead-iron phosphate glass with various types of simulated high-level nuclear waste, a highly corrosion resistant, homogeneous, easily processed glass can be formed. For corroding solutions at 90^0C, with solution pH values in the range between 5 and 9, the corrosion rate of the lead-iron phosphate nuclear waste glass is at least 10^2 to 10^3 times lower than the corrosion rate of a comparable borosilicate nuclear waste glass. The presence of Fe_2O_3 in forming the lead-iron phosphate glass is critical. The lead-iron phosphate waste glasses can be prepared with minimal modification of the technology developed for processing borosilicate glass nuclear wasteforms.

198 **Pyramiding tumuli waste disposal site and method of construction thereof.** Golden, M.P. To Dept. of Energy, Washington, DC. USA Patent 4,842,774. 27 Jun 1989. Filed date 7 Aug 1987. 14p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an improved waste disposal site for the above-ground disposal of low-level nuclear waste as disclosed herein. The disposal site is formed from at least three individual waste-containing tumuli, wherein each tumuli includes a central raised portion bordered by a sloping side portion. Two of the tumuli are constructed at ground level with adjoining side portions, and a third above-ground tumulus is constructed over the mutually adjoining side portions of the ground-level tumuli. Both the floor and the roof of each tumulus includes a layer of water-shedding material such as compacted clay, and the clay layer in the roofs of the two ground-level tumuli form the compacted clay layer of the floor of the third above-ground tumulus. Each tumulus further includes a shield wall, preferably formed from a solid array of low-level handleable nuclear waste packages. The provision of such a shield wall protects workers from potentially harmful radiation when higher-level, non-handleable packages of nuclear waste are stacked in the center of the tumulus.

199 **Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries.** Doherty, J.P.; Marek, J.C. To Dept. of Energy, Washington, DC. USA Patent 4,840,765. 20 Jun 1989. Filed date 25 Feb 1987. Int. Cl. G21F 9/14. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This pattern discusses a process for removing organic compounds from a nuclear waste slurry comprising reacting a mixture of radioactive waste precipitate slurry and an acid in the presence of a catalytically effective amount of a copper presence of a catalytically effective amount of a copper (II) catalyst whereby the organic compounds in the precipitate slurry are hydrolyzed to form volatile organic compounds which are separated from the reacting mixture. The resulting waste slurry, containing less than 10 percent of the original organic compounds, is subsequently blended with high level radioactive sludge and transferred to a vitrification facility for processing into borosilicate glass for long-term storage.

0530 Environmental Aspects

Refer also to citation(s) 134, 135, 138, 140, 142, 143, 144, 146, 148, 152, 154, 156, 163, 164, 165, 166, 167, 168, 169, 170, 175, 180

200 (INIS-BR–1631) **Concentrations of ^{226}Ra and ^{210}Pb in agricultural products surrounding the first brazilian mine and mill in Pocos de Caldas, MG.** Vasconcellos, L.M.H.; Amaral, E.C.S.; Vianna, E.C.M. Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). 1989. 24p. (In Portuguese). Order Number DE90606537. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

As a complement to the pre-operational environmental monitoring program of the Brazilian first uranium mine and mill, a survey of ^{226}Ra and ^{210}Pb in agriculture products, and in the corresponding soils, were carried out in the Pocos de Caldas Plateau. The survey intended to determine site specific transfer factors, in order to better estimate radiation doses on the population. Resulting from the plant operation. In local soils, ^{226}Ra and ^{210}Pb have similar concentrations. The average contents are comparable to the values found in areas of normal radioactivity, but the maximum values are higher by one order of magnitude. In the vegetables analyzed (beans, carrot, corn and potato), ^{226}Ra concentrations are slightly higher than those of ^{210}Pb, and the maximum values are also one order of magnitude greater than in normal regions. For both radionuclides, the average soil-to-plant transfer factors are of the order of 10^{-3} and 10^{-2}, when related to total and to exchangeable contents in soils, respectively. These results led to the conclusion that ^{226}Ra and ^{210}Pb have similar importance, concerning the population exposure via the foodstuff ingestion pathway. Therefore, it was recommended to carry on routine monitoring program for both radionuclides in the main agriculture crops. However, the naturally elevated radionuclide concentrations, in some local vegetables, will decrease the sensitivity for detecting small increments resulting from the plant operation. (author).

201 (INIS-BR–1632) **Evaluation of the ^{226}Ra transport by rivers sediments surroundings the brazilian uraniums mining and milling.** Azevedo, H.L.; Amaral, E.C.S.; Godoy, J.M. Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). 1989. 9p. Order Number DE90606538. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A study of the ^{226}Ra contamination of the rivers sediments surroundings the Brazilian uranium mining and milling was carried out. The total and mondetrital ^{226}Ra concentrations was determined as well as some preliminary speciations measurements. It was not observed increments in the nondetrital fraction when comparing with the pre operational results. The values indicated that the soluble form could be the main path of ^{226}Ra transport. However the critical sampling point supplied to influence from the chemical processing effluent show increments tht indicate to be mainly due to the presence of ^{226}Ra bound with barium sulphate. (author).

202 (PB–89-164735/XAB) **Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee.** Thun, M.J.; Schober, S. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1988. 37p. (HETA–86-381-1934). Available from NTIS, PC A03/MF A01.

In response to a request from the U.S. Nuclear Regulatory Commission, a study was made of excessive kidney disease at Nuclear Fuel Services, Erwin, Tennessee. This facility was the sole producer of nuclear fuel rods for the United States Navy. The major operations involved the production of highly enriched uranium fuel for naval nuclear reactors and the recovery from scrap of low enriched uranium for commercial light water reactors. Highly enriched uranium-hexafluoride was converted to oxides and ultimately into finished nuclear fuel. A medical questionnaire revealed more frequent kidney stones (19%) and urinary tract infections (28%) among the workers than among the guards used as a comparison group, 7 and 12%, respectively. Dairy farmers from a nearby town used as an additional comparison group reported kidney stones more frequently (26 versus 21%) and infections less frequently (20 versus 30%) than the current and former senior workers at the nuclear facility. Kidney function was similar in both groups. Workers in both groups had frequent risk factors for kidney stones, particularly high calcium, oxalate, sodium, uric-acid, phosphorus and low urinary volume on testing. The authors conclude that the urinary tract disorders in the nuclear workers were not the result of occupational hazards at this site.

0540 Health and Safety

Refer also to citation(s) 118, 120, 127, 174, 488, 500, 1003, 1004, 1310, 1311, 1312, 1313, 1314, 1315, 1316

203 (DOE/SSDP–0053) **Shippingport Station Decommissioning Project: Removal of piping and equipment and removal of primary system components.** Westinghouse Hanford Co., Shippingport, PA (USA). Shippingport Station Decommissioning Project Office. 17 Oct 1989. 119p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90001657. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

This report is a technical synopsis of the removal of contaminated and non-contaminated piping and equipment from the Shippingport Station Decommissioning Project (SSDP). The information is provided as a part of the Technology Transfer Program to document dismantling activities in support of reactor decommissioning. 5 refs., 29 figs., 4 tabs.

204 **Estimated routine radiation doses to transportation workers in alternative spent-fuel transportation systems.** Schneider, K.J.; Smith, R.I.; Daling, P.M.; Ross, W.A.; McNair, G.W. *Transactions of the American Nuclear Society (USA),* 57: 7-8 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The federal system for the management of spent fuel and high-level radioactive waste includes the acceptance by the US Department of Energy (DOE) of the spent fuel or waste loaded in casks at the reactor or other waste generators, its transportation to a repository, and its handling and final emplacement in the repository. The DOE plans to implement a transportation system that is safe, secure, efficient, and cost-effective and will meet applicable regulatory safety and security requirements. The DOE commissioned the Pacific Northwest Laboratory (PNL) to develop estimates of the routine radiation doses that would result from the operation of a system postulated using current designs and practices. From that evaluation, PNL identified activities/operations that result in the higher fraction of doses, proposed conceptual alternatives that would effectively reduce such exposures, and evaluated the cost-effectiveness of such alternatives. The study is one of a series used in making overall system design and operational decisions in the development of the DOE's spent-fuel/high-level waste transportation system. This paper contains the highlights from the PNL study of the estimated radiation doses to the transportation workers in a postulated reference transportation system and potential alternatives to that system.

205 **Doses to railroad workers from shipments of radioactive materials.** Fields, D.E. (Oak Ridge National Lab., TN (USA)); Cottrell, W.D. *Transactions of the American Nuclear Society (USA),* 57: 10-11 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Fissile and high-level radioactive wastes are currently transported over long distances by truck and by rail transportation systems. The primary form of fissile material is spent reactor fuel. Transportation operations within the US Department of Energy (DOE) are controlled through the transportation operations and management system. The increase in the rate of shipments projected by DOE has generated increased concern by railroads that railroad workers may be exposed to increased levels of radiation and that exposures may be sufficiently high that a radiation protection program may need to be implemented. It is the policy of DOE to address such concerns in a timely manner. To address railroad concerns, the authors have estimated doses to railroad workers for two exposure scenarios that were constructed using worker activity data obtained from CSX Transportation for crew and maintenance workers. This characterization of railroad worker activity patterns includes a quantitative evaluation of the duration and level of exposure. The maximum individual doses for the shipments and scenarios considered in this paper and based on a line source model, together with dose limits expressed in regulation 10CFR20 and DOE dose limits based on publications by the International Commission on Radiological Protection are summarized.

206 **Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment.** Lavender, J.C.; Hostick, C.J.; Wakeman, B.H. *Transactions of the American Nuclear Society (USA),* 57: 8-9 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper presents actual time/motion data for an oversize truck spent-fuel shipment from its origin, Surry, Virginia to its destination, Idaho National Engineering Laboratory (INEL). These data include the receipt of the empty cask at the reactor, wet-loading the cask, over-the-road or in-transit data, and receipt and dry unloading of the shipping cask at the receiving facility. Occupational doses were recorded at the Surry Power Plant as well as at INEL, and public doses were calculated for the in-transit dose analysis. This shipment was one of a series performed in support of a demonstration and evaluation of dry storage at INEL. The oversized shipment consisted of a TN-8L shipping cask loaded with three 10-yr-old pressurized water reactor assemblies. The total distance traveled was ≈2800 miles, requiring 62 h including stops. The time required to receive and inspect the empty shipping cask and wet-load and release the shipment at the reactor was ≈14.1 h, and the time to receive the loaded cask, dry-transfer the spent fuel to the storage cask, and release the empty cask and trailer at the INEL facility was ≈8.2 h.

207 **Barge shipment and reactor handling of a castor V/21 cask.** Hostick, C.J.; Lavender, J.C.; Wakeman, B.H. *Transactions of the American Nuclear Society (USA),* 57: 9 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The results of this study consist of a complete handling time/dose assessment for barge transport and reactor loading of a Castor V/21 storage cask. Observations are based on the barge transport and spent-fuel loading of storage casks at the Surry, Virginia, nuclear power plant during 1987. The minimum time required to perform all storage cask-handling activities from ship off-loading through placement of the loaded cask in at-reactor storage was 43.8 h. The addition of delays (due to backshifts not worked, etc.) resulted in a total turnaround time for the operation of ≈6 days (24 h/day). Total labor requirement was 136 person-hours. Occupational dose for these activities totaled 416 person-mrem of exposure was due to background dose, representing ≈40% of total dose. The highest dose-producing activity consisted of those steps involved with draining the loaded storage cask (i.e., installing drain pipe and pumping water from cask). This activity resulted in 75 person-mrem of exposure. Lid installation and vacuum drying of the cavity resulted in 56 person-mrem of exposure. The actual loading of spent-fuel assemblies into the storage cask was the third highest dose-contributing activity, resulting in 38 person-mrem of exposure.

208 **Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code.** Luna, R.E.; Neuhauser, K.S.; Reardon, P.C. *Transactions of the American Nuclear Society (USA),* 57: 9 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The RADTRAN III transport risk assessment code can be used to calculate collective doses to the public and to transport workers during the transport and handling of radioactive materials. The code includes mode-specific models for calculation of transport-worker doses during transport, at intermediate stops, and during intermodal transfers and storage. Transport workers and other persons who might be occupationally exposed and are considered in RADTRAN III include transport vehicle crew members, flight attendants, rail classification and inspection personnel, loading dock workers, and warehouse personnel. The study reported here relates RADTRAN III transport-worker dose calculations to actual values for a representative package-a truck cask carrying 10-yr-old pressurized water reactor spent fuel. In this example, the package is modeled as a line source for close-in dose calculation. The differences between the conservative RADTRAN III dose calculations based on transport index (TI) values and the doses calculated by accounting for the orientations and distances of workers in the actual radiation field around the cask are discussed separately for the gamma and neutron components.

209 **Safety team assessments at NRC [Nuclear Regulatory Commission]-licensed fuel facilities.** Sjoblom, G.L. *Transactions of the American Nuclear Society (USA),* 57: 139 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Following the hydraulic rupture of a UF cylinder at the Sequoyah Fuels Facility on January 4, 1986, the US Nuclear Regulatory Commission's (NRC's) executive director for operations (EDO) established an augmented inspection team to investigate the accident. The investigation is reported in NUREG-1179. The EDO then

formed a lessons-learned group to report on the action NRC might reasonably take to prevent similar accidents. The group's recommendations are reported in NUREG-1198. In addition, the EDO formed an independent materials safety regulation review study group (MSRRSG) to review the licensing and inspection program for NRC-licensed fuel cycle and materials facilities. During the same period of time that the MSRRSG report was being prepared and evaluated, the staff undertook an independent action to assess operational safety at each of the 12 major fuel facilities licensed by the NRC. The facilities included the 2 facilities producing uranium hexafluoride, the 7 facilities producing commercial nuclear reactor fuel, and the 3 facilities producing naval reactor fuel. The most important safety issues identified as needing attention by licensees were in the areas of fire protection, chemical hazards identification and mitigation, management controls or quality assurance, safety-related instrumentation and maintenance, and emergency preparedness.

210 **Regulatory actions and initiatives based on results of NRC operational safety assessments of fuel cycle facilities.** Rouse, L.C. *Transactions of the American Nuclear Society (USA)*, 57: 139-140 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Operational safety assessments were conducted at 12 nuclear fuel cycle facilities by multidisciplinary teams formed by the US Nuclear Regulatory Commission (NRC) in 1986 and 1987. The results of these team assessments, which were broader in scope than routine NRC inspections of these facilities, were summarized for the commission in a staff briefing on August 5, 1987. In response to the commission's request for a plan of action to implement improvements in the NRC's regulatory program for fuel cycle facilities, based on the results of the team safety assessments, the staff has initiated actions to strengthen its licensing and inspection programs in the following areas: (a) management controls, including quality assurance and training programs; (b) fire safety; (c) chemical safety; (d) limiting conditions of operation for equipment and instrumentation important to safety, including related surveillance calibration and preventive maintenance provision; and (e) emergency preparedness. The implementation plan calls for the development and publication of staff technical positions in these identified areas to serve as initial guidance for licensees and NRC staff.

211 **A reassessment of criticality safety in the Sellafield separation plant.** Glazbrook, D.J.; Walls, S.J. *Transactions of the American Nuclear Society (USA)*, 57: 140-141 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Magnox Separation Plant at Sellafield in the United Kingdom has operated since 1964 under strict and successful criticality control. In order to meet changing operational requirements and incorporate new plant performance and safety data, the criticality assessments for the plant have been reviewed and revised nine times up to the present. The average number of separate assessments involved at each revision is 20 individual assessments covering a section of the process. The latest set of criticality assessments form part of a fully developed safety case (FDSC), in which assessments for other radiological hazards are also included. The FDSC was delivered to the Nuclear Installations Inspectorate in December 1987 as one aspect of a wide-ranging company response to an external audit. During the latest reassessment exercise, no new contingencies were identified, although some additional maloperations leading to these contingencies were found. Opportunity was taken to update the assessment methods used for hazard identification and analysis. In general, the safety of plant operations has withstood the scrutiny of the latest reassessment, and it has proved possible to simplify the criticality control regime.

212 **ANI [American Nuclear Insurers] support and research facility nuclear liability insurance inspection program.** Ernst, B. *Transactions of the American Nuclear Society (USA)*, 57: 138-139 (1988). (CONF-881011--: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

American Nuclear Insurers (ANI), a voluntary association of insurance companies, provides property and nuclear liability insurance protection to the nuclear industry. It generally offers insurance coverage to nuclear facilities, suppliers, and transporters for the following: (1) their liability for damages because of bodily injury and/or property damage caused by the nuclear energy hazard, and (2) all-risk damage to nuclear facilities. Among the range of facilities and suppliers insured by ANI are (a) operators of nuclear power plants that supply electricity for the general public, (b) operators of nuclear testing and research reactors, (c) fuel fabricators that manufacture fuel for use in reactors, (d) operators of facilities that dispose of nuclear waste that cannot be salvaged, (e) facilities that maintain and repair equipment used at nuclear facilities, (f) nuclear laundries, and (g) low-level-waste processors. The fundamental goal of the ANI nuclear engineering inspection program is to provide protection to pool members' assets by reducing insurance risk.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 335, 495, 501, 929

213 (K/ITP-192) **Safeguards and security recommendations for the OCRWM [Office of Civilian Radioactive Waste Management] Federal Waste Management System.** Moran, B.W.; Fishbone, L.G.; Saling, J.H.; Johnson, E.R.; Wonder, E.F. Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div. 31 Aug 1989. 67p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001498. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The systems and procedures that will be part of the Federal Waste Management System (FWMS) – managed by the US Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management (OCRWM) – will be subject to the requirements of nuclear materials safeguards. The FWMS will include the acceptance of spent nuclear fuel (SNF) and high-level radioactive wastes (HLW) at the generator's site, the transportation of these materials to DOE facilities, the handling and packaging of SNF and HLW, the monitored retrievable storage of SNF, and the disposal of SNF and HLW in a mined geologic repository. The safeguards requirements that must be considered and planned for early in the design of the FWMS facilities and procedures are those specified in the DOE orders and US Nuclear Regulatory Commission (NRC) regulations and those of the International Atomic Energy Agency (IAEA). Early identification of technical and institutional issues can prevent possible delays in the licensing of the FWMS facilities and ensure more economical implementation of the required safeguards elements in the FWMS. This study was performed for OCRWM to determine the safeguards-related activities that should be undertaken, together with the schedules and costs of such activities, to ensure that the FWMS will be able to meet the domestic and international safeguards requirements without the need for expensive backfitting. 20 refs., 4 figs.

214 (LA-UR-89-2046) **A safeguards program to implement DOE requirements.** Erkkila, B.H. Los Alamos National Lab., NM (USA). 1989. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891103--8: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014311. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Department of Energy issued a new Material Control and Accountability (MC&A) Order 5633.3 in February of 1988. This Order contains all of the requirements for an effective MC&A (safeguards) program for facilities that control and account for nuclear materials in their operations. All contractors were expected to come into compliance with the Order by April 30, 1989 or obtain approval for exception and/or extensions. The Order also contains various performance requirements that are not in effect until the DOE issues the guidelines to the performance requirements. After evaluations were completed in February 1989, it was determined there were several deficiencies in the Laboratory safeguards program. Documentation of policy and procedures needed correction before the Laboratory could be in compliance with the new MC&A Order. Differences between the old and new Orders were addressed. After this determination action teams were established to correct the

Laboratory safeguards program. Compliance with the DOE requirements was the goal of this activity. The results of the action teams is the subject of this paper.

215 (LA-UR–89-3171) **Monitoring a liquid waste stream with a delayed-neutron instrument.** Rinard, P.M.; Van Lyssel, T.; Kroncke, K.E.; Schneider, C.M.; Bourret, S.C. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891197–1: Topical meeting on non-destructive assay of radioactive waste, Cadarache (France), 20-22 Nov 1989). Order Number DE90000695. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A flowing raffinate stream is to be continuously assayed by a delayed-neutron instrument to detect concentrations of ^{235}U that could cause a criticality problem in a holding tank. The instrument is to assay a concentration of 0.034 (g ^{235}U)/L in 100 s with a precision of 10% (1 σ) and to operate unattended for a few months at a time, so it can detect and adjust for changes in the neutron background, the flow rate, and for electronic drifts and malfunctions. In laboratory tests with conditions slightly different from what may be found in the plant, repeated assays on a solution with 0.034 (g ^{235}U)/L flowing at 80 L/h through the 2-L assay tank had relative precisions of 9-11%. 5 refs., 5 figs.

216 (SAND–89-1706C) **Application of item and personnel tracking to materials control.** Waddoups, I.G. Sandia National Labs., Albuquerque, NM (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891103–10: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014245. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Materials Control techniques are utilized to provide assurance that nuclear materials are being handled properly. In the event that materials are improperly handled or potentially malevolent activities utilizing nuclear materials are initiated, the materials control approach should provide a real-time indication to allow a rapid mitigating response. The appropriate response can range from correcting an inadvertent error to preventing an intentional insider-perpetrated incident. This paper is directed at the use of materials control techniques to deter and detect insider malevolence. 1 fig.

217 (UCRL–101305) **Evaluating the contributions of material control to insider protection.** Al-Ayat, R.A. Lawrence Livermore National Lab., CA (USA). 29 Jun 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891103–17: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89015706. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Facilities handling nuclear material must be adequately protected against a spectrum of threats including insiders, outsiders, and collusion among insider and outsider adversaries. To counter these threats, facilities implement an integrated system of physical protection (PP), material control (MC), and material accountability (MA). (Personnel Security Assurance Programs are also used to help deter and detect potential insider adversaries.) Naturally, the contribution of each of these systems to protection against the different threats varies. Material control plays an important role in protecting against the insider threat and in assuring that material is where it should be. Evaluating its contributions, however, to the overall protection is challenging. This paper focuses on one of the modules of the ASSESS code — a state-of-the-art safeguards evaluation tool developed jointly with Sandia National Laboratories — and discusses its use for assessing the contributions of MC to an overall insider protection program and for evaluating the safeguards benefits of new MC technologies. 2 refs.

0560 Legislation and Regulations

Refer also to citation(s) 141, 158, 167, 214, 500

218 **Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988.** Rept. 100-931, Part 2. 5p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Energy and Commerce recommends passage of H.R.5232 to grant the consent of the Congress to the Southwestern Low-Level Radioactive Waste Disposal Compact. The compact includes the states of California and Arizona, but North and South Dakota are eligible upon ratification by their legislatures. The compact agreement provides that California will host the disposal facility for the first 30 years. Unless California elects to continue hosting the facility, Arizona (or the member state other than California which generates the largest amount of low-level waste) is required to host the facility for the next 30 years. A site outside Needles, California near the Arizona border has been selected for the initial facility.

219 **Waste Isolation Pilot Plant Land Withdrawal Act of 1987. Hearing before the Subcommittee on Public Lands, National Parks and Forests of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 1272, October 12, 1987.** S. Hrg. 100-609. 286p. Government Printing Office, Washington, DC (US) (1988).

The hearing considers Senate bill S.1272 which would permanently withdraw lands from Eddy County, New Mexico for use by the Department of Energy for the operation of the Waste Isolation Pilot Plant. The bill places limits on the amount and type of wastes and activities that can be carried out at WIPP, requires compliance with EPA standards for the management and disposal of spent nuclear fuels, high-level and transuranic wastes, and requires the use of both engineered and natural barriers to isolate the radioactive waste after disposal. The issues that are discussed are whether the legislation provides adequate attention to health and safety concerns, the effect of a recent court decision that throws out existing EPA regulations for waste repositories, how adequately the DOE has addressed the need for high-level waste experiments, whether towns have received necessary technical and management assistance from DOE to properly deal with the transportation of wastes through these communities, and what transportation issues still need to be resolved. Testimony was heard from 26 witnesses.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

220 (CEA-CONF–9775) **Separation of tritium from other hydrogen isotopes.** Roth, E. Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie. 1988. 24p. (CONF-8806438–: Tokyo Institute of Technology seminar, Tokyo (Japan), 6 Jun 1988). Order Number DE90713878. Available from NTIS (US Sales Only), PC A03/MF A01.

The paper describes a plant that has been operated at Marcoule for tritium production and used thermal diffusion enrichment, a facility that was built in Saclay to enrich hydrogen in tritium for low level measurements, and the Laue Langevin Institute tritium extraction plant. Details are given on the project under construction for the tritium separation facility at JET using Gas Chromatography, and on proposals for circuits for NET. Studies on catalysers for liquid phase catalytic exchange, on electrolysers, or different gas chromatography arrangements, are described. Systems designed for reprocessing plants, for detritiation of heavy water by distillation are briefly accounted for.

0702 Radiation Sources

Refer also to citation(s) 120, 1969, 1971

221 (ISN–89-09) **High energy gamma-ray production in nuclear reactions.** Pinston, J.A.; Nifenecker, H. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. 1989. 67p. Order Number DE90713791. Available from NTIS (US Sales Only), PC A04/MF A01.

Experimental techniques used to study high energy gamma-ray production in nuclear reactions are reviewed. High energy photon production in nucleus-nucleus collisions is discussed. Semi-classical descriptions of the nucleus-nucleus gamma reactions are introduced. Nucleon-nucleon gamma cross sections are considered, including theoretical aspects and experimental data. High energy gamma ray production in proton-nucleus reactions is explained. Theoretical explanations of photon emission in nucleus-nucleus collisions are treated. The contribution of charged pion currents to photon production is mentioned.

222 (N–89-25433) **A slow positron beam generator for lifetime studies.** Singh, J.J.; Eftekhari, A.; St.Clair, T.L. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Apr 1989. 15p. (NASA-TM–101590;NAS–1.15:101590). Available from NTIS, PC A03/MF A01.

A slow positron beam generator using well-annealed polycrystalline tungsten moderators and a Na-22 positron source was developed. A 250 micro c source, deposited on a 2.54 micron thick aluminized mylar, is sandwiched between two (2.54 cm x 2.54 cm x 0.0127 cm) tungsten pieces. Two (2.54 cm x 2.54 cm x t cm) test polymer films insulate the two tungsten moderator pieces from the aluminized mylar source holder (t=0.00127 to 0.0127). A potential difference of 10 to 100 volts–depending on the test polymer film thickness (t)–is applied between the tungsten pieces and the source foil. Thermalized positrons diffusing out of the moderator pieces are attracted to the source foil held at an appropriate potential below the moderator pieces. These positrons have to pass through the test polymer films before they can reach the source foil. The potential difference between the moderator pieces and the aluminized mylar is so adjusted as to force the positrons to stop in the test polymer films. Thus the new generator becomes an effective source of positrons for assaying thin polymer films for their molecular morphology.

223 **Synchrotron radiation sources to provide new probes of matter.** Baum, R.M. (C and EN, San Francisco, CA (US)). *Chemical and Engineering News (USA),* 66(38): 22-26 (19 Sep 1989).

This article discusses the current development of two new synchrotron radiation sources: the Advanced Light Source at Lawrence Berkeley Laboratory and the Advanced Photon Source at Argonne National Laboratory. The authors describe various applications for these sources as well as the broadening effect it will have on applicable scientific experimentation.

224 **Artificial intelligence search techniques for the optimization of cold source geometry.** Azmy, Y.Y. (Oak Ridge National Lab., TN (USA)). *Transactions of the American Nuclear Society (USA),* 57: 97-98 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Most optimization studies of cold neutron sources have concentrated on the numerical prediction or experimental measurement of the cold moderator optimum thickness that produces the largest cold neutron leakage for a given thermal neutron source. Optimizing the geometric shape of the cold source, however, is a more difficult problem because the optimized quantity, the cold neutron leakage, is an implicit function of the shape, which is the unknown in such a study. An analogy is drawn between this problem and a state space search, then a simple artificial intelligence (AI) search technique is used to determine the optimum cold source shape based on a two-group, r-z diffusion model. This AI design concept was implemented in the computer program AID, which consists of two modules, a physical model module, and a search module, which can be independently modified, improved, or made more sophisticated.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

225 (EEO-ED–190/216) **Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead].** Department of Energy, London (UK). Energy Efficiency Office; National Industrial Fuel Efficiency Services Ltd., Altrincham (UK). Feb 1988. 40p. Order Number DE90713735. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

As a result of a joint commercial venture, Bidston Moss, a major waste disposal site on the outskirts of Birkenhead has been transformed into a valuable source of energy which now provides the Premier Brands Factory, 2.5 km away with low cost methane gas to fuel a shell type steam raising boiler. The annual quantity of gas extracted from the landfill site and supplied to Premier Brands during 1986 was 1.048 million therms (110 594 GJ) which gave a nett national energy saving of 3952 tonne of coal equivalent. The actual simple payback periods varied from 3.6 (10% fuel discount) to 4.4 years (20% fuel discount) compared with the predicted values of 2.6 years (10% fuel discount) to 3.1 years (20% fuel discount). (author).

226 (ORNL/Sub–84-90435/1, pp. 106-113) **Effect of applied environmental stress on growth, photosynthesis, carbon allocation, and hydrocarbon production in Euphorbia lathyris.** Taylor, S.E.; Calvin, M. Oak Ridge National Lab., TN (USA); Lawrence Berkeley Lab., CA (USA). Aug 1988. In *Hydrocarbons and energy from plants. Final report, 1984-1987.* Order Number DE88015328. Available from NTIS, PC A08/MF A01.

Photosynthetic activity was reduced by salinity stress, but is was found to be less sensitive than growth. Salinity stress also caused changes in the concentrations of specific cations. Moderate water stress had little effect on growth, but large changes in hydrocarbon production were still observed. Carbon allocation experiments with radiolabeled carbon indicated that carbon for latex production was supplied by nearby leaves, with some translocation down the stem also occurring.

227 (PB–89-178776/XAB) **Chemical and catalytic activation of methane by metal oxide surfaces. Annual report, September 1, 1987-August 31, 1988.** McCarty, J.G.; Quinlan, M.A. SRI International, Menlo Park, CA (USA). Jan 1989. 103p. Available from NTIS, PC A06/MF A01.

See also PB–88-192828.

New stable catalysts composed of alkaline earth ($SrZrO_3$) and rare earth ($LaAlO_3$) refractory oxides showed promising experimental results for methane coupling with premixed oxygen. Unlike the alkali-promoted catalysts, these highly active catalysts were run for 20 hours at 900 deg without loss of activity and without apparent evaporation or corrosive attack on the quartz reactors. The homogeneous and heterogeneous chemistry involved in the selective oxidation of methane and light alkanes and the construction of a self-consistent predictive kinetic model is described. The higher hydrocarbon yield appears to be limited by the homogeneous oxidation of methyl and ethyl radical intermediates. The kinetic model predicts significant yields of CO, H_2, CH_2O, and CH_3OH in addition to the commonly reported C_2H_6 and C_2H_4 primary products; absence of these by products and the predominance of by-product CO_2 is attributed to heterogeneous reactions. The mechanism of co-oxidative methane coupling by basic Na/CaO and complex oxide catalysts continued to be investigated by a variety of dynamic methods including postreaction temperature programmed desorption (TPD) of stable adsorbed intermediates and pulsed flow H-D isotopic exchange between CH_4 and CD_4. Inhibition of the methane conversion for coupling and for H-D exchange by CO_2 suggests that by-product CO_2 can displace the reactive oxygen centers on the surfaces of base oxide catalysts.

0902 Alcohol Fuels

Refer also to citation(s) 5, 938

228 (CRIE-T–87110) **Survey on synthesis technologies of methanol as an alternative fuel.** Oyama, Seiichi; Ozawa,Yasushi; Fukuzawa, Hisashi. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Oct 1988. 44p. (In Japanese). Order Number DE89901303. Available from NTIS (US Sales Only), PC A03/MF A01.

To provide for future utilization of methanol in the electric power industry, the present circumstances on synthesis technologies of

methanol were surveyed. Gas phase methanol synthesis process (the conventional process)uses natural gas or petroleum as the feed, and the reaction conditions are as follows; reaction temperature of 230-400°C, reaction pressure of 50-400 atmospheres, and Cu or Zn system catalyst is used. However the process has low points such as; low yield of the product (10-15%), necessity of recirculation of the unreacted gases, complicated process, poor control of the reaction temperature, and no effective catalyst for the low temperature and low pressure reaction. Recently, liquid phase synthesis process was proposed. The process is said to show high yield of 90% under the reaction conditions of 100°C, 10 atmospheres with inactive solvent such as tetrahydrofuran. Furthermore, the feed stocks with wide range of CO/H_2 ratio can be used with effective reaction temperature and the low manufacturing costs are expected. However, the process is still under development and the subjects to be solved are as follows: catalyst activity at low temperature, high selectivity, long life catalyst, effects of impurities on the catalyst and its measures. 19 refs., 26 figs., 13 tabs.

229 **Process for producing ethanol from plant biomass using the fungus paecilomyces sp.** FuWu, J. To Dept. of Energy, Washington, DC. USA Patent 4,840,903. 20 Jun 1989. Filed date 8 Aug 1985. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a process for producing ethanol from plant biomass is disclosed. The process includes forming a substrate from the biomass with the substrate including hydrolysates of cellulose and hemicellulose. A species of the fungus Paecilomyces, which has the ability to ferment both cellobiose and xylose to ethanol, is then selected and isolated. The substrate is inoculated with this fungus, and the inoculated substrate is then fermented under conditions favorable for cell viability and conversion of hydrolysates to ethanol. Finally, ethanol is recovered from the fermented substrate.

0903 Inorganic Hydrogen Compound Fuels

230 (UCRL–101953) **Using small scale tests to estimate the failure diameter of a propellant.** Tarver, C.M.; Green, L.G. Lawrence Livermore National Lab., CA (USA). 18 Aug 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890811–39: 9. international symposium on detonation, Portland, OR (USA), 28 Aug - 1 sep 1989). Order Number DE90001166. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Electric gun and gas gun shock initiation experiments using embedded manganin pressure gauges were employed to determine high pressure reaction rates of propellants. This reaction rate data was used to develop ignition and growth reactive flow computer models, which then predict the unconfined failure diameter of these propellants. Two ammonium perchlorate/binder/aluminum propellants were studied: one containing no HMX and one containing 12% HMX. The propellant containing no HMX exhibited no reaction in any of the experiments. In the short pulse duration electric gun and the lower pressure gas gun experiments, the HMX-containing propellant exhibited partial reactions indicating that only the 12% HMX reacted. At 20 GPa input pressures the rest of the propellant mixture reacted and the reaction rates were quantitatively measured and calculated. Using these reaction rates, the unconfined failure diameter of the 12% HMX propellant was calculated to be between 2.5 and 3 inches. 6 refs., 14 figs., 3 tabs.

0904 Solid Waste and Wood Fuels

231 (DOE/OR/21389–22) **Northeast regional biomass energy program: Progress report, July 1989–September 1989.** O'Connell, R.A. CONEG Policy Research Center, Inc., Washington, DC (USA). Oct 1989. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE90001915. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Northeast Regional Biomass Program (NRBP) was initiated in August 1983 with a grant to the Coalition of Northeastern Governors (CONEG), Policy Research Center, Inc. from the US Department of Energy's Oak Ridge Operations Office. The program is designed to promote the responsible use of biomass energy in the Northeast region which encompasses eleven states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont). The Program conducted by NRBP has three basic features: (1) a state grant component that provides funds (within a 50 percent matching requirement) to each of the state agencies involved in biomass energy; (2) a series of technical reports and studies in areas that have been identified as being of critical importance to the development of biomass energy in the region; and (3) a continuous long range planning component with heavy private sector involvement that helps to identify activities necessary to spur greater development and use of biomass energy in the Northeast. 1 tab.

232 (EEO-ED–239/210) **Straw as a fuel for chalk drying. A demonstration at Needham Chalks Ltd. [Ipswich].** Department of Energy, London (UK). Energy Efficiency Office. Jan 1989. 39p. Order Number DE90713737. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Under the Energy Efficiency Demonstration Scheme, this project aims to demonstrate the feasibility and the economic viability of using straw to replace fuel oil in the drying of chalk at Needham Chalks Ltd, Suffolk. For the year 1987, assuming the chalk production was 14,000 tonnes of 4% moisture content chalk and 24,000 tonnes of 7% moisture content chalk, it is calculated that there would be a loss of Pound 16,371 using straw instead of fuel oil. However if the costs of fuel oil and straw had remained at the 1983 price (the year of the proposal), annual savings using straw would have been Pound 26,952 which represents a payback period of 7 years. (UK).

233 **Recovery and reuse of cellulase catalyst in an exzymatic cellulose hydrolysis process.** Woodward, J. To Dept. of Energy, Washington, DC. USA Patent 4,840,904. 20 Jun 1989. Filed date 18 Sep 1987. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a process for recovering cellulase from the hydrolysis of cellulose, and reusing it in subsequent hydrolysis procedures. The process utilizes a commercial adsorbent that efficiently removes cellulase from reaction products which can be easily removed by simple decantation.

13 HYDRO ENERGY

234 (DOE/ID–10237) **DOE hydropower program biennial report 1988–1989: (With updated annotated bibliography).** Sommers, G.L.; Chappell, J.R.; Rinehart, B.N.; Hildebrand, S.G.; Sale, M.J.; Allegretti, D.W.; Brown, P.W. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 75p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (MISC–89083). Order Number DE90002008. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report summarizes the research and development and technology transfer activities of the US Department of Energy's (DOE's) Hydropower Program for fiscal years 1988 and 1989, and provides an annotated bibliography of research, engineering, operations, regulations, and costs of projects pertinent to hydropower development. The Hydropower Program is reported in five sections: Technology Development, Engineering Research and Development, Technology Transfer, Environmental Research, and Legal and Industrial Aspects. The bibliography discusses reports written by both private and non-Federal Government sectors. Most reports are available from the National Technical Information Service. 25 refs.

1301 Resources and Availability

235 (DOE/ID/12356–1) **Report on siphon penstocks for hydroelectric projects: Small-Scale Hydroelectric Power.** Acres International Corp., Amherst, NY (USA). Feb 1989. 250p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-82ID12356. Order Number DE90000985. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

This report on the use of siphon penstocks for hydroelectric installations has been prepared under DOE Contract DE-AC07-82ID12356 by Acres International Corporation and draws extensively on the information and data assembled by the following organizations: The purpose of the study was to review the design, construction, operation, and maintenance considerations for siphon penstocks. The discussions, data, and information presented are based on experiences with the following operational siphon penstock plants: A general description of siphon penstocks is presented in Section 2. The benefits and drawbacks of siphon penstocks are summarized in Section 3. Sections 4, 5, 6, and 7 contain a review of the design, construction, operation, and maintenance considerations. The comparative costs of siphon penstocks versus conventional designs are discussed in Section 8. Recommendations for future design, based on the experiences with the above listed projects, are presented in Section 9. Section 10 contains the conclusions which have been made from the review of siphon penstock installations.

1302 Site Geology and Meteorology

236 (CRIE-U–05) **Modal identification and system identification for the soil-structure system.** Hanada, Kazufumi. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Aug 1988. 230p. (In Japanese). Order Number DE89901271. Available from NTIS (US Sales Only), PC A11/MF A01.

With the aim of establishing demonstrative investigation techniques to identify the seismic resistance and design propriety of important structures, techniques to identify the dynamic characteristics such as for rock-structure system modes based on actual and experimental data and the dynamic rigidity comprising the modulus matrix of the vibration equation were investigated, and experimental methods and data processing methods to obtain the basic materials for the identification were described. A dynamic characteristics identification method which is suitable for large-scale rock-structure systems involving interactions and a dynamic rigidity identification method which uses a nonlinear least-square method based on the sensitivity analysis were proposed. In the proposed techniques, in order to prevent excessive adaptation, expectations, deviations, and limitations of the system constants are set, errors due to modeling are estimated, equations matching these factors are formulated, and identification is performed using the specific value disintegration method and straight-line searching. To evaluate the identification methods, various numerical experiments were performed, and these methods have been confirmed to be able to identify true dynamic rigidity or technically appropriate values. 106 refs., 101 figs., 16 tabs.

1303 Plant Design and Operation

Refer also to citation(s) 235

237 (CRIE-U–88018) **Hydraulic design on shaft-type energy dissipator of head-tank spillway.** Fukuhara, Kaichi. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Sep 1988. 39p. (In Japanese). Order Number DE89901295. Available from NTIS (US Sales Only), PC A03/MF A01.

On a shaft type energy dissipator of a head-tank spillway in a run-off-river power plant, an experimental study was carried out to propose a practical design method. The shaft type energy dissipator are composed of the spillway channel, shaft, energy dissipating chamber, discharge tunnel, and air duct. In a straight type, a ventilation space is installed through out the waterway system, and the entrained air is separated at the downstream of the energy dissipator. An experiment was carried out using the straight type model with a scale of one-tenth, and the flow conditions and hydraulic characteristics were obtained changing an angle of inclination of spillway channel, water depth, flow rate, capacity of the energy dissipating chamber, then the design items were determined. In an orifice type, an orifice is installed in the energy dissipating chamber, and the air is separated from the shaft top. The air flow in the water channel was observed through the experiment using the orifice type model, when the discharging tunnel is filled with flowing water. Then a idameter of the shaft, aperture of the orifice and the arrangement of the air duct were studied. As to both types, the new design method, in which the hydraulic conditions at the inflow portion of the shaft are decided as a steady flow and the water depth is fixed to 3/10 of the diameter of the channel, is proposed. 15 refs., 27 figs., 5 tabs.

14 SOLAR ENERGY

238 (JSES–8801) **Abstracts of 1988 JSES-JWEA joint conference.** Fukuda, Hideo; Matsumura, Hirohisa; Tani, Tatsuo; Takeda, Yukihiro; Takigawa, Kiyoshi. Japan Solar Energy Society, Tokyo (Japan). 1 Dec 1988. 322p. (In Japanese). (CONF-881297–: 1988 JSES and JWEA joint conference, Kumamoto (Japan), 1-2 Dec 1988). Order Number DE89900544. Available from NTIS (US Sales Only), PC A14/MF A01.

The abstracts are roughly grouped into areas of solar radiation, photovoltaic power generation, system evaluation, passive solar system, heat pump, material, application of solar energy, heat collector, radiation, and thermal energy storage. In the area of solar radiation, abstracts on the model and evaluation of effect of obstructions on solar radiation, simple integrated-recording film for measurement of total sky radiance, etc. are presented. Accelerated aging test method for a-Si PV module and others are reported in the photovoltaic power generation field, and a simulation method of solar floor heating system and other reports are presented in the system evaluation area. Also reported are studies on the thermal performance of passive air-cycle house and so on in the area of passive solar system, studies on operating performance of a heat pump system using earth tube for residential space heating and cooling and others in relation with heat pump, durability test on selective absorbers and others in the area of materials, and studies on a temperature selective storage tank, influence of Fe $(OH)_3$ colloid for aquifer thermal energy storage method, etc. in connection with the thermal heat storage.

1401 Resources and Availability

Refer also to citation(s) 1237

239 (SERI/PR–215-3338) **SERI [Solar Energy Research Institute] Resource Assessment Project: FY 1987 annual progress report.** Hulstrom, R.L.; Maxwell, E.L.; Riordan, C.J.; Stoffel, T.L. Solar Energy Research Inst., Golden, CO (USA). Mar 1988. 41p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009458. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report provides a summary of the FY 1987 activities and accomplishments of the SERI Solar Radiation Resource Assessment Project (SRRAP). This project is a part of the Resource Assessment Program of the US Department of Energy (DOE). The SERI project is confined to the solar radiation energy resources, while the scope of the DOE program can include other renewable energy sources, such as wind energy. 43 refs., 25 figs., 3 tabs.

1405 Solar Energy Conversion

Refer also to citation(s) 225, 226, 229, 232, 271, 286, 288, 291, 647, 795

240 **Regulation of carbon partitioning in photosynthetic tissue.** Heath, R.L.; Preiss, J. (eds.). 396p. Rockville, MD (US), American Society of Plant Physiologists (1985). Sponsored by U.S. DOE Energy Research. DOE Contract FG03-85ER13334. From 8. annual symposium in plant physiology: regulation of carbon partitioning in photosynthetic tissue; Riverside, CA (USA); 11-12 Jan 1985.

Most researchers in Plant Physiology have come to realize that in order to increase the yield of agriculturally important crops, the processes of photo-synthesis and translocation have to be understood. Once the basic mechanisms are firmly elucidated, geneticists can then try to optimize the interactions between the two processes controlling the movement of the newly fixed carbon throughout the plant. In the seventies, great strides were made in comprehending the regulation occurring within the photosynthetic enzymes, critical in the control of the flow of carbon from the first photosynthetic

product to the more complex carbohydrates which serve as the carbon-transporting agents. While the mechanisms of translocation remain partially obscured, various model systems have been developed over the past decade which should allow researchers a better view over the barriers. Individual papers were processed separately for the data base.

241 (CONF-8908164–1) **Comparison of structural subunits of the core light-harvesting complexes of photosynthetic bacteria.** Loach, P.A.; Parkes-Loach, P.S.; Chang, M.C.; Heller, B.A.; Bustamante, P.L.; Michalski, T. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Molecular biology of photosynthetic prokaryotea symposium; Freiburg (Germany, F.R.); 2-5 Aug 1989. Order Number DE90001412. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of the biochemical methodology for preparation of structural subunits of the core LH complex and their reconstitution from individual components has provided a tool for probing structure-function relationships at three different levels: BCh1 binding, polypeptide interaction within the LH complex, and interaction between the LH complex and the RC. Further cultivation of this experimental approach should provide improved knowledge about how BCh1 is bound and how the LH complex performs its function. 11 refs., 9 figs., 1 tab.

242 (DOE/ER/13574–1) **[Pyruvate decarboxylase: A key enzyme for alcohol production]: Annual performance report, [July 1, 1986–June 30, 1987.** Florida Univ., Gainesville, FL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER13574. Order Number DE90001577. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The overall objectives of this grant are to investigate the properties and regulation of pyruvate decarboxylase from Z. mobilis and to identify the unique features which allow its high level of expression. Steps in the project include enzyme purification and antibody production, characterization of physical and kinetic properties, investigations of how environmental conditions affect the level of pyruvate decarboxylase, its biosynthesis and turnover, cloning and sequencing, investigations of the effects of increased gene dosage, control of m-RNA synthesis and turnover, and promoter structure. 16 refs.

243 (DOE/FTR–90001320) **[Bioproductivity and photosynthesis]: Foreign trip report, September 21–30, 1989.** Hind, G. Brookhaven National Lab., Upton, NY (USA). 18 Oct 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001320. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Professor Mathison and his staff were enthusiastic about bringing the Training Course to the UWI Biology Department and gave full cooperation to this survey. Difficulties emerged in the following areas: inadequate field facilities, shortage of teaching space, potential scheduling conflicts, and lack of certain instruments. The organizing committee should be able to overcome these problems in view of the available lead time.

244 (DOE/OR/21389–23) **Directory of biomass energy facilities in the northeast.** Biomass Energy Service Team, Falmouth, ME (USA). Mar 1989. 339p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE90001933. Available from NTIS, PC A - OSTI; GPO Dep.

The Directory of Biomass Energy Facilities in the Northeast is a comprehensive list of industries, businesses, institutions and utility companies located throughout the Northeast that use wood and wood wastes for fuel. Facilities included in the directory were identified through extensive research on wood energy use in the eleven-state region including Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Maryland and Delaware. The Directory is designed for public and private decision makers interested evaluating the use of woodfuels at their facilities. It provides the name, location, contact person, and general information on approximately 400 industries, businesses and utility companies using wood for energy in 1986. In addition, more extensive information is provided on the design, engineering, maintenance and economics of about 200 wood-fired facilities that provided more detailed descriptions of their operations. The Council of Great Lakes States and the Tennessee Valley Authority have generated similar directories for facilities in their regions.

245 (JSES–8801, pp. 25-28) **Accelerated aging test method for a-Si pr module.** Fujisawa, Kazuya (JMI Inst., Tokyo (Japan)); Nose, Junta; Hiruma, Tsuneyoshi; Mine, Hisaichi. Japan Solar Energy Society, Tokyo (Japan). 1988. (In Japanese). (CONF-881293–Absts.: JSES and JWEA joint conference, Kumamoto (Japan), 1-2 Dec 1988). In *Abstracts of 1988 JSES-JWEA joint conference*. Order Number DE89782162. Available from NTIS (US Sales Only), PC A13/MF A01.

Under the contract awarded by NEDO, standard measuring method and test method are being developed since FY 1980 for the evaluation of performance and weather resistance of solar cells. Noticing marked degradation by light and change by thermal environment of amorphous solar cells, an improved test method was experimented to simulate the degradation pattern in the open air exposure test. A light source lamp was set in a temperature-controllable thermostatic chamber in the light/temperature acceleration test system, and several kinds of experiments were carried out under a constant light with temperatures as parameters. An 1 kW metal-halide lamp was used as the light source. 16 amorphous solar cell modules of the same kinds were used, and the temperature in the chamber was controlled at -15°C, 0°C, 10°C, 20°C, and 30°C respectively. The result of the tests are shown in comparison with the result of the exposure test. 3 figs.

246 (N–89-23025) **InP (Indium Phosphide): Into the future.** Brandhorst, H.W. Jr. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Mar 1989. 10p. (NASA-TM–102058;E–4816;NAS–1.15:102058;CONF-8903157–: 1. international conference on indium phosphide, Norman, OK (USA), 20-22 Mar 1989). Available from NTIS, PC A02/MF A01.

Major industry is beginning to be devoted to indium phosphide and its potential applications. Key to these applications are high speed and radiation tolerance; however the high cost of indium phosphide may be an inhibitor to progress. The broad applicability of indium phosphide to many devices will be discussed with an emphasis on photovoltaics. Major attention is devoted to radiation tolerance and means of reducing cost of devices. Some of the approaches applicable to solar cells may also be relevant to other devices. The intent is to display the impact of visionary leadership in the field and enable the directions and broad applicability of indium phosphide.

247 (N–89-24448) **Space station freedom solar array design development.** Winslow, C.; Bilger, K.; Baraona, C.R. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 6p. (NASA-TM–102105;E–4871;NAS–1.15:102105;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

The Space Station Freedom Solar Array Program is required to provide a 75 kW power module that uses eight solar array (SA) wings over a four-year period in low Earth orbit (LEO). Each wing will be capable of providing 23.4 kW at the 4-year design point. Lockheed Missles and Space Company, Inc. (LMSC) is providing the flexible substrate SAs that must survive exposure to the space environment, including atomic oxygen, for an operating life of fifteen years. Trade studies and development testing, important for evolving any design to maturity, are presently underway at LMSC on the flexible solar array. The trade study and development areas being investigated include solar cell module size, solar cell weld pads, panel stiffener frames, materials inherently resistant to atomic oxygen, and weight reduction design alternatives.

248 (N–89-26041) **Advances in thin-film solar cells for lightweight space photovoltaic power.** Landis, G.A.; Bailey, S.G.; Flood, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 29p. (NASA-TM–102017;E–4734;NAS–1.15:102017;CONF-8906169–: International Astronautics Federation conference on space power, Cleveland, OH (USA), 5-7 Jun 1989). Available from NTIS, PC A03/MF A01.

The present stature and current research directions of photovoltaic arrays as primary power systems for space are reviewed. There have recently been great advances in the technology of thin-film solar cells for terrestrial applications. In a thin-film solar cell the thickness of the active element is only a few microns; transfer of this technology to space arrays could result in ultralow-weight solar arrays with potentially large gains in specific power. Recent advances in thin-film solar cells are reviewed, including polycrystalline copper-indium selenide (CuInSe2) and related I-III-VI2 compounds, polycrystalline cadmium telluride and related II-VI compounds, and amorphous silicon:hydrogen and alloys. The best experimental efficiency on thin-film solar cells to date is 12 percent AMO for CuInSe2. This efficiency is likely to be increased in the next few years. The radiation tolerance of thin-film materials is far greater than that of single-crystal materials. CuInSe2 shows no degradation when exposed to 1 MeV electrons. Experimental evidence also suggests that most of all of the radiation damage on thin-films can be removed by a low temperature anneal. The possibility of thin-film multibandgap cascade solar cells is discussed, including the tradeoffs between monolithic and mechanically stacked cells. The best current efficiency for a cascade is 12.5 percent AMO for an amorphous silicon on CuInSe2 multibandgap combination. Higher efficiencies are expected in the future. For several missions, including solar-electric propulsion, a manned Mars mission, and lunar exploration and manufacturing, thin-film photovolatic arrays may be a mission-enabling technology.

249 (N–89-26043) **Solar cell radiation handbook. Addendum 1: 1982-1988.** Anspaugh, B.E. Jet Propulsion Lab., Pasadena, CA (USA). Feb 1989. 47p. (NASA-CR–185465;JPL-PUBL–82-69-ADD-1;NAS–1.26:185465). Available from NTIS, PC A03/MF A01.

The Solar Cell Radiation Handbook (JPL Publication 82-69) is updated. In order to maintain currency of solar cell radiation data, recent solar cell designs have been acquired, irradiated with 1 MeV electrons, and measured. The results of these radiation experiments are reported.

250 (N–89-26177) **Comparative thermal analysis of the space station Freedom photovoltaic deployable boom structure using TRASYS, NEVADA, and SINDA programs.** Baumeister, J.F.; Beach, D.E.; Armand, S.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jul 1989. 10p. (NASA-TM–102062;E–4819;NAS–1.15:102062;CONF-8907155–: 19. intersociety conference on environmental systems, San Diego, CA (USA), 24-26 Jul 1989). Available from NTIS, PC A02/MF A01.

The proposed Space Station Photovoltaic Deployable Boom was analyzed for operating temperatures. The boom glass/epoxy structure design needs protective shielding from environmental degradation. The protective shielding optical properties (solar absorptivity and emissivity) dictate the operating temperatures of the boom components. The Space Station Boom protective shielding must also withstand the effects of the extendible/retractable coiling action within the mast canister. A thermal analysis method was developed for the Space Station Deployable Boom to predict transient temperatures for a variety of surface properties. The modeling procedures used to evaluate temperatures within the boom structure incorporated the TRASYS, NEVADA, and SINDA thermal analysis programs. Use of these programs led to a comparison between TRASYS and NEVADA analysis methods. Comparing TRASYS and NEVADA results exposed differences in the environmental solar flux predictions.

251 (N–89-26291) **The GaAs solar cells with V-grooved emitters.** Bailey, S.G.; Fatemi, N.; Wilt, D.M.; Landis, G.A.; Thomas, R.D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 6p. (NASA-TM–102104;E–4870;NAS–1.15:102104;CONF-8910243–: European space power conference, Madrid (Spain), 2-6 Oct 1989). Available from NTIS, PC A02/MF A01.

Geometrically structured surfaces have become increasingly important to solar cell efficiency improvements and radiation tolerance. Gallium arsenide solar cells with a V-grooved front surface which demonstrate improved optical coupling and higher short-circuit current compared to planar cells were fabricated. GaAs homojunction cells were fabricated by organometallic chemical vapor deposition (OMCVD) on an n+ substrate. The V-grooves were formed on the surface with an anisotropic etch, and an n-type buffer and p-type emitter were grown by OMCVD, followed by ohmic contacts. Reflectivity measurements show significantly lower reflectance for the microgrooved cell compared to the planar structure. The short circuit current of the V-grooved solar cell is consistently higher than that of the planar controls.

252 (N–89-26292) **On-orbit results of the LIPS 3/InP homojunction solar cell experiment.** Brinker, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 7p. (NASA-TM–102131;E–4921;NAS–1.15:102131;CONF-8910243–: European space power conference, Madrid (Spain), 2-6 Oct 1989). Available from NTIS, PC A02/MF A01.

The flight performance of NASA Lewis Research Center's indium phosphide homojunction solar cell module on the LIPS 3 satellite is presented. A module of four n+p cells was fabricated and has been on-orbit on the LIPS 3 spacecraft since 1987. The experimental objective is the measurement of InP cell performance in the natural radiation environment of the 1100 kilometer altitude, 60 deg inclination, circular orbit. Flight data from the first year is near expected values, with no degradation in short-circuit current. The temperature dependence of current-voltage parameters is included along with the laboratory radiation tolerance studies necessary for normalization and analysis of the data. Details of the cell structure and flight module design are also discussed.

253 (N–89-26799) **Solar power for the lunar night.** Landis, G.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. May 1989. 19p. (NASA-TM–102127;E–4913;NAS–1.15:102127;CONF-8905228–: 9. biennial SSI/Princeton conference on space manufacturing, Princeton, NJ (USA), 10 May 1989). Available from NTIS, PC A03/MF A01.

Providing power over the 354 hour lunar night provides a considerable challenge to solar power concepts for a moonbase. Concepts are reviewed for providing night power for a solar powered moonbase. The categories of solutions considered are electrical storage, physical storage, transmitted power, and innovative concepts. Electrical storage is the most well-developed option. Less developed electrical storage options are capacitors and superconducting inductors. Physical storage options include storage of potential energy and storage of energy in flywheels. Thermal storage has potentially high energy/weight, but problems of conduction and radiation losses during the night need to be addressed. Transmitted power considers use of microwave or laser beams to transmit power either from orbit or directly from the Earth. Finally, innovative concepts proposed include reflecting light from orbital mirrors, locating the moonbase at a lunar pole, converting reflected Earthlight, or moving the moonbase to follow the sun.

254 (PNL–7126) **Low-temperature conversion of high-moisture biomass: Continuous reactor system results.** Elliott, D.C.; Sealock, L.J. Jr.; Butner, R.S.; Baker, E.G.; Neuenschwander, G.G. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 56p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90000984. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Pacific Northwest Laboratory (PNL) is developing a low-temperature, catalytic process for converting high-moisture biomass feedstocks and other wet organic substances to useful gaseous fuels. This system, in which thermocatalytic conversion takes place in an aqueous environment, was designed to overcome the problems usually encountered with high-water-content feedstocks. The process uses a reduced nickel catalyst at temperatures as low as 350°C and pressures ranging from 2000 to 4000 psig – conditions favoring the formation of gas consisting mostly of methane. The results of numerous batch tests showed that the system could convert feedstocks not readily converted by conventional methods. Fifteen tests were conducted in a continuous reactor system to further evaluate the effectiveness of the process for high-moisture biomass gasification and to obtain conversion rate data needed for process scaleup. During the tests, the complex gasification reactions were evaluated by several analytical methods. The results of these tests show that the heating value of the gas ranged from 400 to 500 Btu/scf, and if the carbon dioxide is removed, the product gas is

pipeline quality. Conversion of the feedstocks was high. Engineering analysis indicates that, based on these results, a tubular reactor can be designed that should convert greater than 99% of the carbon fed as high-moisture biomass to a gaseous product in a reaction time of less than 11 min.

255 (SAND–89-1900C) **Current status of InAsSb strained-layer superlattice infrared detectors: Demonstration of a high detectivity, 10 μm photodiode.** Kurtz, S.R.; Dawson, L.R.; Zipperian, T.E.; Whaley, R.D. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8908159–1: IRIS conference, Monterey, CA (USA), 14-17 Aug 1989). Order Number DE90000800. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A high detectivity infrared photodiode was constructed using an $InAs_{0.15}Sb_{0.85}$/InSb strained-layer superlattice (SLS). The surface passivated device exhibited detectivities $\geq 1 \times 10^{10}$ $cm\sqrt{Hz}/W$ at wavelengths ≤ 10 μm. This device demonstrates the feasibility of a long wavelength, photovoltaic infrared detector technology based on InAsSb SLSs. 8 refs., 4 figs.

256 **Silicon material quality and throughput: The high and the low, the fast and the slow. .** Ciszek, T.F. (Solar Energy Research Inst., Golden, CO (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A trade-off between quality, conveniently monitored by measurement of the minority-charge carrier lifetime tau, and cost-related concerns such as silicon throughput is inevitably involved in choosing a process for conversion of polycrystalline silicon to crystalline or semicrystalline ingots or sheets. At one extreme, there is high-purity, dislocation-free, float-zoned silicon with tau $\geq$ 1 ms. Material like this allows sophisticated solar cell designs with high conversion efficiency, and provides a vehicle to explore new concepts for PV devices. The costs of premium-quality silicon are relatively high. At the other extreme, multicrystalline silicon is produced by simpler high-throughput processes with lower ultimate costs. Sacrifices in cell performance are typically required to achieve this. These cost vs. performance trade-offs are explored and some of the resultant changes in silicon properties are discussed in the context of current US R and D approaches.

257 **Multijunction III-V solar cells: Recent and projected results. .** MacMillan, H.F. (Varian Associates, Inc., Palo Alto, CA (USA). Varian Research Center); Hamaker, H.C.; Virshup, G.F.; Werthen, J.G. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The purpose of this paper is to discuss Varian's strategy for developing high-efficiency multijunction cells and to discuss the importance of these results within that context. Recent cell performance data are reviewed and compared to computer modeling performance projections for two- and three-junction cascade cells. Results are presented for single and multijunction, monolithic structures (fabricated with the AlGaAs-GaAs-InGaAs materials system grown by MOCVD. The problems and progress for lattice-matched and lattice-mismatched structures and cell interconnects are discussed and assessed. The latest results are significant steps toward demonstration of the viability of cascade cells. The hurdles ahead to be overcome in achieving efficiencies above 30% are discussed.

258 **Advances in material/cell/submodule research in the DOE/SERI amorphous silicon research project.** Wallace, W. (Solar Energy Research Inst., Golden, CO (USA)); Ohi, J.; Luft, W.; Stafford, B.; Sabisky, E. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Recent progress is reviewed with respect to advances in material, cell, and submodule research in the DOE/SERI Amorphous Silicon Research Project (ASRP). A new three-year Government/Industry partnership program was initiated in 1987 directed toward achieving the following objectives in 1990: efficiencies of 10% and 13%, respectively, for amorphous silicon single-junction and multijunction submodules (1000 cm^2) and and efficiency of 18% for multijunction cells (1 cm^2), with associated stability criteria. Efficiency levels are currently at 9.4% and 11.1% for single-junction and multijunction submodules and 13%-14% for multijunction cells. A review is also given of major highlights in fundamental research activities.

259 **Analytical chemical diagnostic testing of environmental exposed thin-film PV modules.** Longrigg, P. (Solar Energy Research Inst., Golden, CO (USA)); Nelson, A.J.; Swartzlander, A.B.; Matson, R. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Subsequent to the work reported in August 1987 on the accelerated stress testing of thin-film α-Si modules, in which a 30% increase was noted in series resistance, further analytical work on the subject modules has been carried out, and is reported here.

260 **Antimony-doped dendritic web silicon solar cells.** Meier, D.L. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center); Spitznagel, J.A.; Greggi, J.; Campbell, R.B. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Antimony has been explored as a dopant in dendritic web silicon in an attempt to achieve uniformity in resistivity through the thickness and along the length of the web ribbon, and to inhibit the formation of deleterious oxide precipitates. The desired uniformity has been achieved. This enabled the fabrication of efficient, n-base bifacial cells using high resistivity (10-100 ohm-cm) web and the growth of web over long periods of time (five days) without replenishing the dopant in the melt. Antimony-doped web cells have been fabricated with measured hole diffusion lengths up to 333 μm and hole lifetimes up to 66 μs. Such diffusion lengths significantly exceed the typical web thickness (100 to 125 μm), thereby satisfying an important requirement for high efficiency cells.

261 **28% efficient GaAs concentrator solar cells.** MacMillan, H.F. (Varian Research Center, Palo Alto, CA (US)); Hamaker, H.C.; Kaminar, N.R.; Kuryla, M.S.; Ladle Ristow, M.; Liu, D.D.; Virshup, G.F.; Gee, J.M. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

AlGaAs/GaAs heteroface solar concentrator cells which exhibit efficiencies in excess of 27% at high solar concentrations (>400 suns, AM1.5D, 100 mW/cm^2) have been fabricated with both n/p and p/n configurations. The best n/p cell achieved an efficiency of 28.1% around 400 suns, and the best p/n cell achieved an efficiency of 27.5% around 1000 suns. The high performance of these GaAs concentrator cells compared to earlier high-efficiency cells was due to improved control of the MOCVD growth conditions and improved cell fabrication procedures (gridline definition and edge passivation). The design parameters of the solar cell structures and optimized grid pattern were determined with a realistic computer modeling program. An evaluation of the device characteristics and implications regarding future GaAs concentrator cell development is presented.

262 **Influence of oxygen on the performance of silicon solar cells.** Sopori, B.L. (Solar Energy Research Inst., Golden, CO (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The influences of dissolved and precipitation oxygen in silicon on the solar cell performance are identified. It is shown that oxygen concentrations up to 5×10^{17} cm^{-3} can indeed be beneficial for improving cell performance. Presence of precipitated oxygen, which can often accompany dissolved oxygen concentrations beyond 5×10^{17} cm^{-3}, strongly influence the cell performance. The dominant mechanisms influencing the cell parameters are discussed. The implications of these results are discussed in the light of material requirements for high efficiency solar cells.

263 **Measurement precautions for high-resistivity silicon solar cells.** King, D.L. (Sandia National Labs., Albuquerque, NM (USA)); Gee, J.M.; Hansen, B.R. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Due to features such as bulk carrier lifetimes on the order of 1 ms, excellent surface passivation, and light trapping, several measurement characteristics have been identified that are unique to high-performance, high-resistivity silicon cells. These unique characteristics can lead to large performance measurement errors. They also offer insight to the physical mechanisms occurring in these devices. Topics discussed and illustrated with measured results in this work include a strong fill factor dependence on voltage sweep rate and direction, sublinear short-circuit current versus irradiance, light soaking influence on open-circuit voltage and fill factor, and enhanced spectral response beyond 1100 nm due to optical light trapping.

264 **The effect of parasitic absorption losses on light trapping in thin silicon solar cells.** Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Recently, methods to enhance the optical absorption (i.e. light trapping) of thin silicon solar cells have been investigated by several groups. The authors have investigated the effect of parasitic absorption (PA) losses on light trapping in thin silicon cells. Parasitic absorption refers to an optical absorption process which does not generate an electron/hole pair; it competes with band-to-band absorption to decrease the photocurrent. A simple model for light trapping that includes PA is described for interpretation of experimental dta. The sub-bandgap reflectance is shown to be a sensitive and quantitative indicator of PA losses. Finally, minimization of the PA losses is shown to be as important as optimization of the light-trapping geometry for increased photogeneration in light-trapping thin silicon solar cells.

265 **Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells.** Leboeuf, C.M. (Solar Energy Research Inst., Golden, CO (USA)); Kurtz, S.R.; Olson, J.M. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Epitaxially grown films of $Al_{0.25}Ga_{0.75}As$ and $Ga_{0.5}In_{0.5}P$ were treated in a Kaufman hydrogen ion beam system to evaluate defect passivation. Films were characterized by measuring the electrochemical I-V profile before and after treatment. After passivation, the authors observed an increase in short circuit current for some $Al_{0.25}Ga_{0.75}As$ films as high as 50%, but also observed deactivation of shallow states. To reactivate shallow levels in $Al_{0.25}Ga_{0.75}As$, a brief anneal (5-10 min) at 400 to 425 C was adequate. Annealing the $Ga_{0.5}In_{0.5}$ films in a phosphine atmosphere at temperatures up to 550 C has been thus far ineffective at restoring the carrier concentration.

266 **Material quality and design optimization for high efficiency GaAs solar cells.** Ringel, S.A. (Georgia Inst. of Tech., Atlanta, GA (USA). School of Electrical Engineering); Rohatgi, A. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A methodology is developed to determine minority carrier lifetime and recombination velocity in high efficiency GaAs p/n heteroface solar cells. A combination of measurements and modeling is used to demonstrate that a base lifetime of 8 ns and a heteroface recombination velocity of 1.25×10^5 cm/s were necessary to simulate the spectral response, cell data, and leakage current in a 21.2% efficient GaAs cell. In addition, it is shown that the doping dependence of the Shockley-Read-Hall lifetime is an important consideration in GaAs device modeling.

267 **Modeling and simulation of InP homojunction solar cells.** Yahia, A.H. (Solar Energy Research Inst., Golden, CO (USA)); Wanlass, M.W.; Coutts, T.J. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Modeling and simulation of single-crystal InP homojunction solar cells have been performed using the PC-1D code. A comparison is made of the predictions of the PC-1D model with that of other models. The authors indicate that improvement in the emitter bulk properties could be much more important than the SRV. The model shows that significant gains would result if this could be achieved. Other loss mechanisms are discussed and, in particular, it is shown that recombination in the base, for good quality material, is relatively insignificant. Possible methods of achieving surface passivation are discussed and these may be important in the event that the bulk emitter losses could be ameliorated.

268 **High altitude current-voltage measurement of GaAs/Ge solar cells.** Hart, R.E. Jr. (NASA Lewis Research Center, Cleveland, OH (US)); Brinker, D.J.; Emery, K.A. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Measurements of high voltage (V_{oc} of 1.2 volts) gallium arsenide on germanium tandem junction solar cells at Air Mass 0.22 show that the insolation in the red portion of the solar spectrum is insufficient to obtain high fill factor. Based on measurements in the LeRC X-25L solar simulator, these cells are believed to be as efficient as 21.68% AMO. Solar simulator spectrum errors in the red end allow the fil factor to be as high as 78.7%. When a similar cell's current-voltage characteristic is measured at high altitude, in the NASA Lear Jet Facility, a loss of 15 percentage points in fill factor is observed. This decrease is caused by insufficient current in the germanium bottom cell of the tandem stack.

269 **The effects of high level injection on the performance of high intensity, high efficiency silicon solar cells.** Banghart, E.K. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering); Gray, J.L.; Schwartz, R.J. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

With SCAP2D, a two-dimensional numerical code for silicon solar cells, the authors have explored the mechanisms controlling performance in high intensity high efficiency cells, focusing on the point contact cell for which record efficiencies have been reported. Their studies demonstrate that accurate predictions of the intensity dependence of the short circuit current and open circuit voltage of these cells can be obtained by the inclusion of free carrier bandgap narrowing in the base and the reduction of the minority carrier mobility in the base to approximately one-half the conventional value of Caughy and Thomas. In addition, the value for the ambipolar Auger coefficient by Dziewior and Schmid is retained. Band gap narrowing due to high injection conditions in the base may be another important limiting factor in silicon solar cells.

270 **A 21.8% $GaInP_2$/GaAs tandem solar cell.** Olson, J.M. (Solar Energy Research Inst., Golden, CO (USA)); Kurtz, S.R.; Kibbler, A.E. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A two-terminal, monolithic cascade solar cell is reported with an efficiency of 21.8% (η_{sc} = 11.8 mA/cm^2, V_{oc} = 2.19 V, and fill factor = 85% under AM 1.5 global conditions, cell area = 1 cm^2). The device structure is two n-on-p cells, $Ga_{0.5}In_{0.5}P$ (hereafter, $GaInP_2$) and GaAs, with a GaAs tunnel diode cell interconnect. The films were grown in a vertical flow MOCVD reactor at 700 C, using trimethylgallium, trimethylindium, arsine, and phosphine, and diethylzinc and hydrogen selenide as dopants. The band gaps of the $GaInP_2$ and GaAs layers are 1.9 and 1.42 eV, respectively. The tandem combination of these two materials is lattice matched, and has a theoretical efficiency of 34%.

1406 Photovoltaic Power Systems

271 (JSES–8801, pp. 33-36) **Evaluation of photovoltaic modules in downtown of Tokyo.** Tani, Tatsuo (Science Univ. of Tokyo (Japan)); Sugita, Toshio; Harada, Yuichiro. Japan Solar Energy Society, Tokyo (Japan). 1988. (In Japanese). (CONF-881293–: JSES and JWEA joint conference, Kumamoto (Japan), 1-2 Dec 1988). In *Abstracts of 1988 JSES-JWEA joint conference.* Order Number DE89900544. Available from NTIS (US Sales Only), PC A14/MF A01.

For solar cell applications, it is important to elucidate the effect of spectral characteristics of solar radiation energy on the output of the solar cell. A report is made on the research whose target is to develop an optimum design method for photovoltaic power generation, elucidating the relation of the spectral characteristics of solar radiation energy in the downtown of Tokyo with the output characteristics of solar cell modules. To start with, description is made on a method of obtaining absolute sensitivity of the solar cell by the standard spectral of solar radiation energy and relative sensitivity characteristics by wavelength of the solar cell. Then, each output is calculated by the measured data of the distribution characteristics by wavelength of solar radiation including sky light at horizontal surface and the absolute sensitivity of 3 kinds of solar cells to see how these values will change according to different seasons and times. The output of the solar cell module depends largely on the conversion efficiency of the amount of solar radiation, and it was learned that the solar radiation spectral must be taken into consideration. 4 refs., 6 figs.

272 (N–89-23397) **Comparison of solar photovoltaic and nuclear reactor power systems for a human-tended lunar observatory.** Hickman, J.M.; Bloomfield, H.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 7p. (NASA-TM–102015;E–4729;NAS–1.15:102015;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

Photovoltaic and nuclear surface power systems were examined at the 20 to 100 kW power level range for use at a human-tended lunar astronomical observatory, and estimates of the power system masses were made. One system, consisting of an SP-100 thermoelectric nuclear power supply integrated with a lunar lander, is recommended for further study due to its low system mass, potential for modular growth, and applicability to other surface power missions, particularly in the Martian system.

273 (N–89-24529) **Photovoltaic power system operation in the Mars environment.** Appelbaum, J.; Flood, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 13p. (NASA-TM–102075;E–4740;NAS–1.15:102075;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A03/MF A01.

Detailed information on the environmental conditions on Mars are very desirable for the design of photovoltaic systems for establishing outposts on the Martian surface. The variation of solar insolation (global, direct, and diffuse) at the Viking lander's locations is addressed. It can be used, to a first approximation, for other latitudes. The radiation data is based on measured optical depth of the Martian atmosphere derived from images taken of the sun with a special diode on the Viking cameras; and computation based on multiple wavelength and multiple scattering of the solar radiation. The data are used to make estimates of photovoltaic system power, area and mass for a surface power system using regenerative fuel cells for storage and nighttime operation.

274 (N–89-25280) **Estimated performance and future potential of solar dynamic and photovoltaic power systems for selected LEO and HEO missions.** Bents, D.J.; Lu, C.Y. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 13p. (NASA-TM–102083;E–4846;NAS–1.15:102083;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A03/MF A01.

Solar Photovoltaic (PV) and thermal dynamic power systems for application to selected Low Earth Orbit (LEO) and High Eccentric Orbit (Energy) (HEO) missions are characterized in the regime 7 to 35 kWe. Input parameters to the characterization are varied corresponding to anticipated introduction of improved or new technologies. Comparative assessment is made between the two power system types utilizing newly emerging technologies in cells and arrays, energy storage, optical surfaces, heat engines, thermal energy storage, and thermal management. The assessment is made to common ground rules and assumptions. The four missions (space station, sun-synchronous, Van Allen belt and GEO) are representative of the anticipated range of multi-kWe earth orbit missions. System characterizations include all required subsystems, including power conditioning, cabling, structure, to deliver electrical power to the user. Performance is estimated on the basis of three different levels of component technology: (1) state-of-art, (2) near-term, and (3) advanced technologies. These range from planar array silicon/IPV nickel hydrogen batteries and Brayton systems at 1000 K to thin film GaAs with high energy density secondary batteries or regenerative fuel cells and 1300 K Stirling systems with ultralightweight concentrators and radiators. The system estimates include design margin for performance degradations from the known environmental mechanisms (micrometeoroids and space debris, atomic oxygen, electron and proton flux) which are modeled and applied depending on the mission. The results give expected performance, mass and drag of multi-kWe earth orbiting solar power systems and show how overall system figures of merit will improve as new component technologies are incorporated.

275 (N–89-25506) **Challenges for future space power systems.** Brandhorst, H.W. Jr. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 6p. (NASA-TM–102063;E–4820;NAS–1.15:102063;CONF-8910243–: European space power conference, Madrid (Spain), 2-6 Oct 1989). Available from NTIS, PC A02/MF A01.

The future appears rich in missions that will extend the frontiers of knowledge, human presence in space, and opportunities for profitable commerce. The key to success of these ventures is the availability of plentiful, cost effective electric power and assured, low cost access to space. While forecasts of space power needs are problematic, an assessment of future needs based on terrestrial experience was made. These needs fall into three broad categories-survival, self sufficiency and industrialization. The cost of delivering payloads to orbital locations from low earth orbit (LEO) to Mars was determined and future launch cost reductions projected. From these factors, then, projections of the performance necessary for future solar and nuclear space power options were made. These goals are largely dependent upon orbital location and energy storage needs.

1407 Solar Thermal Power Systems

Refer also to citation(s) 274

276 (N–89-24440) **Flight experiment of thermal energy storage.** Namkoong, D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 9p. (NASA-TM–102081;E–4843;NAS–1.15:102081;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

Brayton and Stirling power systems under current considerations for missions in the near future require working fluid temperatures in the 1100 to 1300+ K range. TES materials that meet these requirements fall into the fluoride family of salts. These salts store energy as a heat of fusion, thereby transferring heat to the fluid at constant temperature during shade. The principal feature of fluorides that must be taken into account is the change in volume that occurs with melting and freezing. Salts shrink as they solidify, a change reaching 30 percent for some salts. The location of voids that form as result of the shrinkage is critical when the solar dynamic system reemerges into the sun. Hot spots can develop in the TES container or the container can become distorted if the melting salt cannot expand elsewhere. Analysis of the transient, two-phase phenomenon is being incorporated into a three-dimensional computer code. The code is capable of analysis under microgravity as well as 1 g. The objective of the flight program is to verify the predictions of the code, particularly of the void location and its effect on containment

temperature. The four experimental packages comprising the program will be the first tests of melting and freezing conducted under microgravity. Each test package will be installed in a Getaway Special container to be carried by the shuttle. The package will be self-contained and independent of shuttle operations other than the initial opening of the container lid and the final closing of the lid. Upon the return of the test package from flight, the TES container will be radiographed and finally partitioned to examine the exact location and shape of the void. Visual inspection of the void and the temperature data during flight will constitute the bases for code verification.

277 (N–89-25269) **Solar dynamic power module design.** Secunde, R.R.; Labus, T.L.; Lovely, R.G. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 11p. (NASA-TM–102055;E–4808;NAS–1.15:102055;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A03/MF A01.

Studies have shown that use of solar dynamic (SD) power for the growth eras of the Space Station Freedom program will result in life cycle cost savings when compared to power supplied by photovoltaic sources. In the SD power module, a concentrator collects and focuses solar energy into a heat receiver which has integral thermal energy storage. A power conversion unit (PCU) based on the closed Brayton thermodynamic cycle removes thermal energy from the receiver and converts that energy to electrical energy. Since the closed Brayton cycle is a single phase gas cycle, the conversion hardware (heat exchangers, turbine, compressor, etc.) can be designed for operation in low earth orbit, and tested with confidence in test facilities on earth before launch into space. The concentrator subassemblies will be aligned and the receiver/PCU/radiator combination completely assembled and charged with gas and cooling liquid on earth before launch to, and assembly on orbit.

278 (N–89-25273) **Space station freedom photovoltaic power module design status.** Jimenez, A.P.; Hoberecht, M.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 6p. (NASA-TM–102073;E–4832;NAS–1.15:102073;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

Electric power generation for Space Station Freedom will be provided by four photovoltaic (PV) power modules using silicon solar cells during Phase 1 operation. Each PV power module requires two solar arrays with 32,800 solar cells generating 18.75 kW of dc power for a total of 75 kW. A portion of this power will be stored in nickel-hydrogen batteries for use during eclipse, and the balance will be processed and converted to 20 kHz ac power for distribution to end users through the power management and distribution system. The design incorporates an optimized thermal control system, pointing and tracking provision with the application of gimbals, and the use of orbital replacement units (ORU's) to achieve modularization. Design status of the PV power module, as derived from major trade studies, is discussed at hardware levels ranging from component to system. Details of the design are presented where appropriate.

1408 Ocean Energy Systems

279 (CONF-8909128–4) **Biofouling and corrosion research for marine heat exchangers.** Thomas, A.; Hillis, D.L. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Oceans '89 conference; Seattle, WA (USA); 18-21 Sep 1989. Order Number DE90001432. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimental research on biofouling and corrosion of heat-exchange materials in warm and cold seawater was carried out between 1977 and 1987 for the US Department of Energy's Ocean Thermal Energy Conversion (OTEC) program. Major findings include the following: (1) there is negligible biofouling from deep (600 m) seawater; (2) biofouling from warm surface seawater can be controlled by intermittent chlorination at environmentally acceptable levels; (3) the uniform rate of corrosion for aluminum is acceptable in both warm and cold seawater with no pitting observed in warm seawater; (4) some aluminum alloys show good resistance to pitting in cold seawater; and (5) the use of claddings and other protective measures does not now appear to be cost effective. From these and other experiments, we conclude that marine heat exchangers need not be designed for cleaning by mechanical methods, and that aluminum-based materials can be considered for marine applications. 3 refs., 8 figs.

1409 Solar Thermal Utilization

Refer also to citation(s) 685

280 (CONF-890828–2) **Application of solar technologies in buildings.** Flowers, L.T.; Groff, G.C. Solar Energy Research Inst., Golden, CO (USA). [1989]. 10p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. From 2. world congress on heating, ventilating, refrigerating and air conditioning; Sarajevo (Yugoslavia); 27 Aug - 1 sep 1989. Order Number DE90001727. Available from NTIS, PC A02/MF A01 - OSTI.

The objective of the buildings energy research carried out at SERI is to provide the buildings industry with technological innovations in materials, components, and systems that enable them to reduce the usage and cost of energy. The scope of research includes eight technology areas, including advanced windows, storage material composites, advanced insulation, desiccant cooling, air management, building performance monitoring, building design guidelines, and active water heating. This paper outlines the benefits, the results to date, and the current research activities associated with these eight technology options. 16 refs., 6 figs.

281 (ETDE-IT–89-03) **Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools).** Zabot, S.; Bhargava, A.K.; Fumagalli, S.; Soma, L.; Mahajan, S.; Conti, F. Comitato Nazionale per l'Energia Nucleare, Frascati (Italy); Commission of the European Communities, Ispra (Italy). Joint Research Centre. Sep 1987. 5p. (CONF-870902–4: ICBEM '87: international congress on building energy management, Lausanne (Switzerland), 28 Sep - 2 oct 1987). Order Number DE89793120. Available from NTIS (US Sales Only), PC A02/MF A01.

This paper describes a thermal performance evaluation of passive solar and hybrid systems installed in two school buildings of the Region of Lombardy (Italy). The chosen methodology was aimed to determine the passive gains and to evaluate the thermal performance of various building subsystems (conventional boiler, solar air heater, etc.). The conduction heat loss coefficient and the infiltration rate were obtained, respectively, by means of co-heating and tracer gas measurement techniques. The results show how trivial errors in installing solar components can lead to lower energy performance and considerable waste of energy. To date, many solar systems have been installed in Italy. However, due to lack of detailed knowledge of solar systems due to underestimation of increased complexity of hybrid systems, the effect of these systems often does not correspond to design expectations. The defects noted show an impelling need for the training of qualified personnel in design, installation and management in hybrid solar systems.

282 (FRNC-TH–3500) **Delayed thermal supply in a building using a heat collector and storage porous concrete wall.** Khedari, J. Perpignan Univ., 66 (France). 1987. 140p. (In French). Order Number DE90713664. Available from NTIS (US Sales Only), PC A07.

The aim of the study was to evaluate the delayed thermal gains of a porous concrete wall collecting and storing the solar energy at the southside of a building. The wall is covered with a glazing and a dynamic air flow circulates around the wall (front and back). The stored heat is supplied to the rooms during the night and a flow regulation system is developed. A simulator model is used to adjust heat demand with heat supply.

283 (FRNC-TH–3507) **Contribution to the modelling of passive solar buildings. Validation and study of the sensitivity factors.** Baleynaud, J.M. Toulouse-3 Univ., 31 (France). 1987. 239p. (In French). Order Number DE90713663. Available from NTIS (US Sales Only), PC A11.

After a review and an analysis of the different heat transfer modes occurring on a building, a simulation model based on the heat balances is presented. An experimental building cell has been constructed and tested. The experimental building cell have been constructed and tested. The experimental results are used to validate the model in the basis of daily air temperature evolution. Sensitivity factors are derived which allow to evaluate the effects of various parameters (orientation, geometry, ground and lateral insulation, absorption properties,...).

284 (FRNC-TH-3509) **Study and Experiments of a solar energy system with air collector, underground heat storage and recovery with a heat pump.** Bourhaleb, H. Lille Univ., 59 - Valenciennes (France). Centre Universitaire. 1987. 168p. (In French). Order Number DE90713662. Available from NTIS (US Sales Only), PC A08.

A solar energy space heating system is presented and analyzed; the system is composed of an air-soil heat exchanger burried in the soil (1.80m) around the house, and receiving the heat collected by the air solar collectors. A water-water heat pump is used in winter to recover the calories stored in the ground. Experimental results are given.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 284

285 (N-89-24438) **Concentration of off-axis radiation by solar concentrators for space power.** Jefferies, K.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 10p. (NASA-TM-102052;E-4804;NAS-1.15:102052;CONF-890815-: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

Off-axis radiation is radiation from any direction not parallel to the axis of the solar concentrator. It will be reflected to regions other than the focus of the parabolic concentrator and possibly concentrated there. Four types of off-axis radiation are discussed. These are: (1) small off-axis angles during walk-off; (2) large off-axis angles; (3) an extended off-axis source such as Earth albedo; and (4) miscellaneous off-axis sources including radio frequency sources and local point sources. A previous analytical study used a computer code named PIXEL to predict concentration of off-axis radiation and a previous experimental study used an 11-m diameter multifaceted dish concentrator to validate the PIXEL analysis. The PIXEL code was limited in that it represented concentration by an ideal parabolic reflector of light from a point source. Another code named OFFSET has been developed to represent the solar concentrator being developed for Space Station Freedom. It is a detailed, ray tracing model which represents 50 ray originating points on the Sun and reflections from 10 points on each of the 456 concentrator facets. Results of this code are generally similar to the PIXEL results although there are small differences due to the more detailed representations of the Sun and concentrator that were used in the OFFSET code.

286 **A summary of recent photovoltaic concentrator technology developments.** Boes, E.C. (Sandia National Labs., Albuquerque, NM (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965-: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The authors see a significant increase in research and development of photovoltaic concentrator technology. In all, more than 10 development teams are known to be pursuing PV concentrator technology in the U.S. Over half of these development efforts have not been reported to date. This paper summarizes these development efforts. It describes and compares the different designs being developed. It also discusses the relative advantages and disadvantages of the different designs, both in terms of performance and cost. The developmental status of these projects is described, including a summary of available performance information on components and modules. This paper also describes current development efforts on PV concentrator components, including concentrator cells, Fresnel lenses and secondaries, and cell assemblies.

287 **Evaluation of the SOLAR ONE and CESA-I experimental receiver and storage systems.** Castro, M. (Escuela Technica Superior de Ingenieros Industriales, Madrid (ES)); Presa, J.L.; Peire, J.; Skinrod, A.C.; Baker, A.; Faas, S. pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202-: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

The Joint Evaluation Project of the SOLAR ONE (Barstow, California, U.S.A.) and CESA-I (Almeria, SPAIN) Receiver and Storage Systems is sponsored by the U.S. - Spain Joint Committee and is carried out in America for the S.N.L. Livermore, and in Spain for the Electronic Engineering Department, Polythecnic University, Madrid. The evaluation of these subsystems is accomplished in a parallel way by means of similar test plans on both plants, allowing obtaining comparable results. This comparative study between the Receiver systems of both plants, one of open type and other of cavity types, and between the storage systems one or two tanks respectively, allows to compare their performance, efficiency and features. Thus, the design type more suitable in the future to meet the requirements of these solar plant subsystems can be defined.

288 **Recent advances in high-efficiency InGaAs concentrator cells.** Werthen, J.G. (Varian Research Center, Palo Alto, CA (US)); Arau, B.A.; Ford, C.W.; Kaminar, N.R.; Kuryla, M.S.; Ladle Ristow, M.; Lewis, C.R.; McMillan, H.F.; Virshup, G.F.; Gee, J.M. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965-: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

InGaAs concentrator cells with bandgaps of 1.15 eV and 1.35 eV have been developed. These cells are intended for eventual use in dual- and triple-junction tandem solar cells, respectively. The InGaAs cell structures were grown by MOCVD on GaAs substrates with grading layers to accommodate lattice mismatch. Efficiencies greater than 24% at 400 suns (AM1.5D, 100 mW/cm^2) have been demonstrated by InGaAs cells with either bandgap. Since the 1.15-eV InGaAs has a bandgap close to silicon, comparison of the photovoltaic effect in materials with direct and indirect bandgaps is possible. The InGaAs demonstrates open-circuit voltage up to 800 mW (130 mW higher than Si) under concentration. Conversely, Si demonstrates a one-sun short-circuit current of 42 mA/cm^2 compared to 31 mA/cm^2 for InGaAs. Possible reasons for the higher voltages given, and implications regarding projected tandem cell performance are discussed.

289 **A 31%-efficient GaAs/silicon mechanically stacked, multijunction concentrator solar cell.** Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)); Virshup, G.F. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965-: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Development and demonstration of a GaAs/silicon mechanically stacked, multi-junction (MSMJ) solar concentrator cell with an efficiency in excess of 30% is reported. This is the highest efficiency ever reported for a solar cell and this is the first solar cell to ever achieve an efficiency in excess of 30%. The author's preliminary analysis suggests that an efficiency approaching 35% is possible with GaAs-based MSMJ cells.

290 **Minority carrier lifetime degradation in Si concentrator solar cells.** Joardar, K. (Arizona State Univ., Tempe, AZ (USA). Center for Solid State Science); Schroder, D.K.; Backus, C.E. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965-: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Using a simple variation of the Open Circuit Voltage Decay method of lifetime measurement the authors have measured the dependence of minority carrier lifetimes in silicon concentrator cells upon the intensity of incident light. They have measured effective lifetimes at intensity levels of up to 500 suns obtained by concentrating natural sunlight. These measurements were performed on cells of different resistivities and base widths. It was found in all

cases that the effective lifetime decreases as the illumination intensity is increased. The authors quantitatively account for the observed degradation in lifetime.

291 **Concentrator efficiencies of 29.2% for a GaAs cell and 24.8% for a mounted cell-lens assembly.** Kaminar, N.R. (Varian Research Center, Palo Alto, CA (US)); Liu, D.D.; MacMillan, H.F.; Partain, L.D.; LadleRistow, M.; Virshup, G.F.; Gee, J.M. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A lens/cell efficiency of 24.8% has been obtained in an outdoor test using a single GaAs cell and a Fresnel lens. This is the highest efficiency ever reported for a lens/cell assembly. During the test, the cell was water cooled to a junction temperature of 45°C and the concentration ratio was 205:1. In a related test, a 29.2% cell efficiency was obtained using a GaAs concentrator cell and an Entech prismatic cover glass designed to reduce the effect of shadowing of the grid lines.

1420 Heat Storage

Refer also to citation(s) 287

15 GEOTHERMAL ENERGY

292 (GRSJ–8901) **Exploration and development of geothermal resources.** Geothermal Research Society of Japan, Tsukuba (Japan). 10 Nov 1988. 634p. (CONF-881170–: International symposium on geothermal energy, Kumamoto (Japan), 10-14 Nov 1988). Order Number DE89782366. Available from NTIS (US Sales Only), PC A99/MF A01.

An international symposium on geothermal energy was held in Japan in October 1988 with the theme Exploration and development of geothermal resources. 18 countries participated and 187 presentations were given. Two plenary lectures were given; a report on geothermy from New Zealand, and a report from Japan on the development of down-hole pumps that are the result of the Sunshine Project. Classifying the presentations by items; 16 presentations were on geology and geochemistry, 25 on geophysics, 12 on power generation and heat exchange, 14 on reservoir engineering and reinjection, 17 on heat source, 12 on heat flow and general thermal problems, 8 on low enthalpy system and direct use, 22 on hydraulic fracturing and drilling, and 59 presentations were on other items. The order of participating countries according to the number of their presentations was Japan, the United States, New Zealand, China, the USSR, Thailand, West Germany, Canada and Italy respectively. 790 refs., 634 figs., 84 tabs.

1501 Resource Status and Assessment

293 (LA–11550-MS) **An economic prefeasibility study of geothermal energy development at Platanares, Honduras.** Trocki, L.K. Los Alamos National Lab., NM (USA). Sep 1989. 115p. Sponsored by U.S. Agency for International Development. DOE Contract W-7405-ENG-36. Order Number DE90001388. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The expected economic benefits from development of a geothermal power plant at Platanares in the Department of Copan, Honduras are evaluated in this report. The economic benefits of geothermal plants ranging in size from a 10-MW plant in the shallow reservoir to a 20-, 30-, 55-, or 110-MW plant in the assumed deeper reservoir were measured by computing optimal expansion plans for each size of geothermal plant. Savings are computed as the difference in present value cost between a plan that contains no geothermal plant and one that does. Present value savings in millions of 1987 dollars range from $25 million for the 10-MW plant to $110 million for the 110-MW plant – savings of 6% to 25% over the time period 1988 through 2008. 8 refs., 9 figs., 6 tabs.

1503 Geothermal Exploration and Exploration Technology

294 (LA–11510-MS-Pt.2) **Results of investigation at the Miravalles geothermal field, Costa Rica: Part 2, Downhole fluid sampling.** Grigsby, C.O.; Goff, F.; Trujillo, P.E. Jr.; Counce, D.A.; Dennis, B.; Kolar, J.; Corrales, R. Los Alamos National Lab., NM (USA). Oct 1989. 122p. Sponsored by U.S. Agency for International Development. DOE Contract W-7405-ENG-36. Order Number DE90001891. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Samples of the geothermal fluids in the Miravalles, Costa Rica, geothermal system were collected from production wellbores using downhole fluid samplers, from flowing wellheads using miniseparators, and from hot springs that discharge in the area. The reservoir fluid at Miravalles is a neutral-chloride-type water, but fumaroles and acid-sulfate springs are present within the main thermal area, and there are bicarbonate-rich hot springs that are clearly related to the neutral-chloride reservoir fluids. Dissolved gases are primarily a mixture of CO_2 with air, but samples collected in the fumarolic areas also contain H_2S. Water-stable isotope analyses suggest local meteoric recharge, and the reservoir fluid shows oxygen isotopic shifts of about 2.5% due to high-temperature oxygen exchange between water and rock. Chemical geothermometer temperatures are consistent with the measured downhole temperature of 220° to 255°C. This pattern of neutral-chloride reservoir fluids with acid-sulfate springs near the source region and bicarbonate-rich chloride hot springs at the periphery of the system suggests a lateral outflow type of hydrothermal system. In addition to the geochemical evidence, temperature profiles from several of the wells show temperature reversals that are characteristic of lateral outflow plumes. We find no evidence for the underlying, higher temperature (300°C) system, which has been suggested by other investigators. 24 refs., 14 figs., 6 tabs.

1505 Economic and Financial Aspects

Refer also to citation(s) 293

1506 Environmental Aspects and Waste Disposal

295 (NEDOJ–P-8715) **Review of research and evaluation methods for environmental survey in geothermal development.** New Energy Development Organization, Tokyo (Japan). Mar 1988. 408p. (In Japanese). Order Number DE89782628. Available from NTIS (US Sales Only), PC A18/MF A01.

For geothermal development, it is important to evaluate natural environment such as natural parks in the research level of geothermal resources reserves. The aim of this survey is to develop this evaluation method, to study the way to introduce the method to the geothermal development survey, and ultimately to coordinate it with natural parks and to make industrial surveys smooth. In this survey, the present methods of in-situ survey and their problems have been studied, and from which viewpoint the survey methods must be selected for the reserves survey is explained with many examples. In natural environment field, especially in animals and plants, there has been no authorized evaluation standard so far, and the most important subject is how to find out protection objects. In landscape evaluation, it is necessary to put much stress on the surface evaluation of the region rather than on the evaluation of each factor. To verify this evaluation procedure, a case study of Inawashiro region was carried out. 2 refs., 3 figs., 23 tabs.

1508 Geothermal Power Plants

296 (EGG-M–88242) **Geothermal heat cycle research supercritical cycle with counterflow condenser in different orientations.** Blem, C.J.; Mines, G.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-881045–9: Annual meeting of the Geothermal Resources Council, San Diego, CA (USA), 9-12 Oct 1988). Order Number DE90002014. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Heat Cycle Research Program, which is conducted for the Department of Energy, has as its objective the development of the technology for effecting the improved utilization of moderate temperature geothermal resources. The current testing involves the investigation of binary power cycle performance utilizing mixtures of non-adjacent hydrocarbons as the working fluids, with supercritical vaporization and in-tube condensation of the working fluid. The utilization of these concepts verified here will improve the net geofluid effectiveness (net watt hours plant output per pound of geofluid) about 20% over that of a conventional binary power plant. The major effect in this improvement is the ability to achieve integral, countercurrent condensation. Results are presented for the recent testing including those tests examining the performance of the countercurrent condenser at different tube inclinations and comparison with new design-base computer programs. 9 refs., 9 figs.

1509 Geothermal Engineering

297 (LBL–26612-Vol.3) **The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 3: Appendices F through I.** Aunzo, Z.; Bodvarsson, G.S.; Laky, C.; Lippmann, M.J.; Steingrimsson, B.; Truesdell, A.H.; Witherspoon, P.A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 373p. Sponsored by U.S. Agency for International Development; U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002459. Available from NTIS, PC A16/MF A01 - OSTI; GPO Dep.

These are appendices F through I of the Ahuachapan Geothermal Field Reservoir Analysis. The volume contains: well logs, water chemistry plots, gas chemistry plots, temperature plots, and flow plots. (JEF)

298 (SAND–87-7141) **Cemented NbC-Co for geothermal drilling applications: Final report.** Rowcliffe, D.J. Sandia National Labs., Albuquerque, NM (USA); SRI International, Menlo Park, CA (USA). Materials Research Lab. Jun 1989. 24p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE90002088. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sintering and hot isostatic pressing were explored to produce a range of NbC-Co materials. Stoichiometric NbC-10Co and NbC-20Co were sintered close to the theoretical density relatively easily. Cemented $NbC_{0.83}$-10Co and $NbC_{0.83}$-20Co were more difficult to process. Some dense materials were prepared by a combination of sintering and hot isostatic pressing at 1420° to 1450°C. The carbide in these samples appeared to have the composition $NbC_{0.9}$. Hardness, toughness,and wear tests showed that the properties of these $NbC_{0.9}$-10Co samples were inferior to those of $NbC_{0.83}$-10Co materials produced previously by hot pressing. We concluded that contamination from WC milling balls and excessive processing times were the main causes of the difficulty in controlling the composition and properties of substoichiometric cemented niobium carbide. 3 figs., 7 tabs.

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

299 (ETSU-N–106) **Technology module for shoreline wave energy conversion in the UK.** Martin, D.J. UKAEA Harwell Lab. (UK). Energy Technology Div. Apr 1989. 26p. Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

An estimate is made of the likely economic attractiveness and contribution to electricity generation in the UK from shoreline wave energy. Two cases are considered: an isolated supply for island communities at a power size of 20 MW; secondly central grid supply with 250 MW. The transmission costs from the most favourable islands off the West and North of Scotland generally make the latter case unattractive against coal or nuclear power. The former case is more attractive as a supplement for diesel generated power. (UK).

20 ELECTRIC POWER ENGINEERING

Refer also to citation(s) 649

2001 Power Plants and Power Generation

Refer also to citation(s) 9, 228, 321, 322, 323, 1085, 1089, 1213, 1837

300 (CONF-891046–3) **Assessment of fouling, erosion, and corrosion of coal-fired gas turbines.** Ahluwalia, R.K.; Im, K.H. Argonne National Lab., IL (USA). 1989. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Advanced research and technology development; Morgantown, WV (USA); 3-5 Oct 1989. Order Number DE90001939. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of coal-fired gas turbines requires deposition, erosion, and corrosion (DEC) protection of turbines from ash contaminants in the products of combustion. The present task has been concerned with the development of semi-phenomenological models for predicting DEC modes of interaction between and contaminants and the blade surface as a function of turbine operating conditions and fuel chemistry. The contaminants entering a coal-fired gas turbine will consist of particulate matter (flyash, nucleated ash and unburnt char) and vapor species (primarily alkali sulfates). Previous work entailed analytical models that describe the following: condensation of alkali sulfate and refractory oxide vapors in a gas turbine environment; deposition of particles/vapor on pressure/suction surfaces of turbine blades; effect of boundary layer nucleation on mass transfer of alkali sulfates to cooled turbine blades; corrosion correlations for turbine alloys; and flyash adhesion on pressure surface. 16 refs., 2 tabs.

301 (CRIE-T–87100) **Analysis of phenomena at paralleling between power systems by AC-DC power simulator.** Jojo, Kazumasa; Taniguchi, Haruhito; Kitauchi, Yoshihiro; Takashiba, Osamu; Hioki, Eiji; Fujita, Hidenori; Yamada, Masaru; Matsumoto, Hiroyuki; Okumoto, Yoshiharu. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Nov 1988. 56p. (In Japanese). Order Number DE89901264. Available from NTIS (US Sales Only), PC A04/MF A01.

Conditions to parallel the separated power system by a route fault in a trunk transmission line at early were studied.The experiments were carried out between power systems with two generators by AC-DC power system simulator to grasp the interaction between generators. Frequency difference Δf and phase difference $\Delta\theta$ at both ends of system parallel point were used as parameters.Variables of No.1 and 2 generators damped with large fluctuations at 1 to 2 second frequency.Minimum generator voltage decreased with the increases of Δf and $\Delta\theta$ during fluctuation.Stability limit for parallel operation depends large on Δf and $\Delta\theta$.When No.1 generator is operated manually in place of governor-free, stability becomes worse, proving governor effect. Dynamic phenomena between No.1 and No.2 generators were different due to the interaction between two generators and No.2 generator was stable although No.1 showed the step out. Experimental results and simulated ones agreed well at severe paralleling condition,revealing the applicability to multi-power systems. 3 refs., 43 figs., 5 tabs.

302 (EPRI-GS–6576) **Targeted chlorination schedules: Final report.** Sengupta, S. Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA); Miami Univ., Coral Gables, FL (USA). c Oct 1989. 364p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electric Power Research Institute (EPRI) sponsored the development of targeted chlorination, a technique that uses chlorine effectively, improves thermal performance, and meets regulatory requirements for chlorine effluents. In 1986, targeted chlorination schedules and the effects on corrosion potential were investigated. A heat-exchanger test facility was constructed at the University of Miami to evaluate 12 chlorination scenarios. A chlorination predictive model was calibrated to help translate schedules to other sites. The results indicated that a 0.5 to 2 ppM dosage applied for 10 to 15 minutes, two or more times per day, can be successful in maintaining the cleanliness of condenser tubes. In 1987–1988, a

full-scale demonstration was conducted at the Brayton Point Station – Unit 2. 46 refs., 121 figs., 21 tabs.

303 (EPRI-NP–6542) **Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report.** Booser, E.R.; Cohen, M.; Lukas, H. Electric Power Research Inst., Palo Alto, CA (USA); Encotech, Inc., Schenectady, NY (USA). Sep 1989. 125p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report summarizes the review of world-wide experience with the use of fire-resistant fluids in steam and gas turbines. The emphasis is on operating history and technical problems that have been encountered. The report discusses solutions to known operating problems and suggests technical programs for future research and development to assure long-term trouble-free operation. In summary, it is felt that, based on current operating history, fire-resistant fluids can safely be used in small to medium steam turbine-generators with minimal risk. Extended application in larger machines will require more experience in smaller machines, some large scale testing, and a broader experience base with the large machines themselves. 19 refs., 12 figs., 19 tabs.

304 (N–89-22891, pp. 19-39) **Rotor instability due to a gear coupling connected to a bearingless sun wheel of a planetary gear.** Buehlmann, E.T. (Swiss Locomotive and Machine Works Ltd., Winterthrup); Luzi, A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Feb 1989. (NASA-CP–3026;E–4227;NAS–1.55:3026;CONF-8805321–: Workshop on rotordynamic instability problems in high-performance turbomachinery, College Station, TX (USA), 16-18 May 1988). In *Rotordynamic Instability Problems in High-Performance Turbomachinery, 1988.* Available from NTIS, PC A20/MF A01.

A 21 MW electric power generating unit comprises a gas turbine, a planetary gear, and a generator connected together by gear couplings. For simplicity of the design and high performance the pinion of the gear has no bearing. It is centered by the planet wheels only. The original design showed a strong instability and a natural frequency increasing with the load between 2 and 6.5 MW. In this operating range the natural frequency was below the operating speed of the gas turbine, n sub PT = 7729 RPM. By shortening the pinion shaft and reduction of its moment of inertia the unstable natural frequency was shifted well above the operating speed. With that measure the unit now operates with stability in the entire load range.

305 (ORNL/Sub–85-27488/04) **Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989.** Ferro, P.D.; Black, R.D.; Coulombe, B.D.; Li, Che-Yu. Oak Ridge National Lab., TN (USA); Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering. 1 Sep 1989. 29p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90002128. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When given the appropriate thermo-mechanical treatment modified 316 stainless steel and iron-base alloy 800H show equivalent flow strength, however the optimum treatments are found to differ for the two alloys. Effects of grain structure on deformation properties of these alloys are investigated. The long-term stability of the steels was found to exceed the design requirements for a plant lifetime of thirty years. 13 refs., 18 figs.

306 **Lessons learned in a systemwide implementation of RCM.** Smith, A.M.; Hinchcliffe, G.R. *Transactions of the American Nuclear Society (USA),* 57: 183-185 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Florida Power & Light (FPL) has initiated a series of actions aimed at achieving very high levels of availability in their 25 operating fossil units. A policy deployment system is used to focus the organization resources on common efforts that support such goals. The process by which this is accomplished is shown. The predictive maintenance program is shown as a specific subelement of the reliability availability management program (RAMP), which in turn supports the specific tactical agenda item (TAI) of interest here. The implementation of the program at FPL has encountered several new challenges, and three of these, together with their solutions, are discussed here: culture, resources, and timing. The classic RCM methodology is being employed. A pilot study at the Port Everglades 400-MW (electric) unit established the validity and effectiveness of this approach. The RCM process is now being employed in high-priority systems and equipment in order to put an optimized predictive maintenance program in place as quickly as possible on a systemwide basis.

307 **Extending the service life of 15KV polyethylene URD cable using silicone liquid.** Kirkham, H. (Jet Propulsion Lab., Pasadena, CA (USA)); Johnston, A.R. *IEEE Transactions on Power Delivery (USA),* 4(4): 1997-2004 (Oct 1989).

This paper describes methods and materials used to extend the useful life ot extruded polyethylene insulated cables rated 15KV that have developed electrochemical trees in the insulation of sufficient severity to cause service failures. Earlier rehabilitation methods treated extruded dielectric cable with both gases and insulating liquids. This new method fills the cable and impregnates the insulation with a silicone liquid. This liquid, which is reactive, significantly improves the voltage breakdown strength of the cables, which has been reduced by electrochemical trees, and extends the useful service life of the cable. A review of the criteria used to develop the silicone liquid for this application and the methodology used to inject it into the cable will be discussed. An assessment of the costs of this life extension indicates a significantly lower cost than conventional cable replacement with little disturbance to the service and property of the customer.

2002 Environmental Control Technology

Refer also to citation(s) 26, 331

308 (CRIE-U–88041) **Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment.** Chigira, Masahiro. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Dec 1988. 30p. (In Japanese). Order Number DE89901296. Available from NTIS (US Sales Only), PC A03/MF A01.

Pliocene mudstone was experimentally weathered by acid and oxygen to clarify the mechanism of weathering of sedimentary mudstone. And various factors exerting an influence on the weathering were studied in order to make possible to expand site condition for a large scale power plant through an adequate evaluation of the basement rock. Cylindrical pieces of mudstone with porosity of 59-62% were left in a water under unstressed condition or uniaxial stressed condition of 5 kgf/cm^2, controlling the pH, dissolved oxygen and temperature as long as 70 days. The experiment made the rings of oxidation zone and dissolution zone at the inner side of the oxidation zone; the two zones have been observed at the natural weathering zone. The migration rate of the oxidation front depends on only the dissolved oxygen, the migration rate of the dissolution front depends on the pH and compressive stress. Calcite in the mudstone decreases or disappears at the dissolution front, and shows largely decreasing the density and increasing the porosity at the dissolution front, these trends are also recognized at the oxidation front. 9 refs., 9 figs., 3 tabs.

309 (EPRI-EN–6518-Vol.1) **EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 1, User's manual.** Electric Power Research Inst., Palo Alto, CA (USA); Enertech Consultants, Campbell, CA (USA). c Oct 1989. 86p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The EPRI Electric and Magnetic Field Digital EXposure (EMDEX) system consists of hardware and software for characterizing electric and magnetic field exposures. The EMDEX meter is a computer-based portable unit that samples, at a user-programmable rate, the three vector components of magnetic flux density, a measure of the average electric field acting on the torso of the wearer (if an optional sensor is worn) and a measure of rotational motion of the meter in the earth's magnetic field. Modules of the DATACALC software package are used to program the EMDEX, retrieve data at the end of a measurement session, analyze EMDEX data, and prepare

tabular and graphical data summaries. The User Manual is designed to provide instruction on the use of the exposure system hardware and software. The Technical Reference Manual provides additional, detailed descriptions of the hardware, software and methodologies used in the EMDEX system.

310 (EPRI-GS–6281) **Proceedings: Reducing power plant emissions by controlling coal quality.** Electric Power Research Inst., Palo Alto, CA (USA); Writing Consultants Associated, Pittsburgh, PA (USA). c Oct 1989. 209p. Sponsored by Electric Power Research Institute. (CONF-8710500–: Seminar on reducing power plant emissions by controlling coal quality, Bethesda, MD (USA), 27-28 Oct 1987). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report contains the proceedings of 14 papers delivered at the EPRI seminar. The major topics of the seminar were particulate emissions, trace elements, integrated environmental control, and acid rain. Speakers from EPRI as well as from design firms, utilities, research centers, and regulatory agencies examined the effects of coal quality on the three major types of emissions from coal-fired plants: gases (SO_x and NO_x), particulates and trace elements. The seminar also included addresses by representatives of the US DOE and Environment Canada. Speakers used computer models, industry-proven methods, and theories backed by laboratory tests to relate coal quality to ESP performance, emission predictions, and trace element control. Individual projects are processed separately for the data bases.

311 (PB–89-221378/XAB) **SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989.** Stern, R.D.; Sedman, C.B.; Princiotta, F.T. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 15p. (EPA–600/D-89/041). Available from NTIS, PC A03/MF A01.

This paper describes work in several areas relating to reducing SO_2 and NOx emissions from coal-fired utility boilers and provides an overview of objectives, approach, current status, and plans for each. In addition, it describes plans for a small-scale selective catalytic-reduction system. SO_2 and NOx are major pollutants resulting from fuel combustion. Coal-fired utility boilers account for about 65% of the SO_2 and 29% of the NOx emissions in the U.S. These pollutants are generally believed to be major precursors of acid rain, and their control is a significant concern of the U.S. EPA, the utility industry, and other private and public organizations. The national strategy for reducing acid rain is still being debated in Congress; the choice of a strategy will determine the control techniques for limiting SO_2 and NOx emissions from utility boilers and will most likely include a mix of technologies to achieve the desired reduction at minimum cost.

312 **Gas reburning-sorbent injection for controlling SO_{chl} and NO_{chl} utility boilers.** Bartok, W.; Folsom, B.A.; Elbl, M.; Kurzynske, F.R.; Ritz, H.J. 23p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 64B.

As part of DOE's Clean Coal Technology program, a field evaluation of Gas Reburning-Sorbent Injection (GR-SI) technology is being carried out by EER Corporation. The project is co-funded by the Gas Research Institute and the State of Illinois Department of Energy and Natural Resources. GR-SI technology is applicable to the control of emissions of acid rain precursor species, oxides of nitrogen and sulfur from coal fired utility boilers. Three units representative of pre-NSPS design practices, a 117 MW_e wall, a 71 MW_e tangentially, and a 33 MW_e cyclone fired boiler located in Illinois will be the host sites for this three-phase demonstration project. Phase I, Design and Permitting, is nearing completion. Results of Phase I and plans for subsequent work are discussed.

2003 Power Transmission and Distribution

Refer also to citation(s) 301, 650, 1364

313 (CRIE-T–87081) **Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator.** Taniguchi, Haruhito; Asada, Minoru; Sakurai, Takeichi; Kojima, Yukio; Sato, Nobuyuki; Tamura, Yasuo; Satake, Koji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 63p. (In Japanese). Order Number DE89901258. Available from NTIS (US Sales Only), PC A04/MF A01.

Application of parametric resonance theory to power systems is one of the effective approaches to explain unstable phenomena observed in overseas power systems such as long-term poor damping oscillations. Parametric resonance in power systems, which is deeply related to non-linearities of swing equation, is classified into the following two types and the authors have already proved the existence of these resonances theoretically and confirmed it by simulations as well. (1) Hetero-parametric resonance which is caused by periodic disturbances such as periodic load variations. (2) Autoparametric resonance which is the interference among some dominant oscillation modes to be triggered by temporary disturbances such as short circuit faults. This paper confirms parametric resonance phenomena, especially autoparametric ones, in laboratory experiments using an artificial transmission systems and micro-machines. Comparing the theory with laboratory experiments and simulations is discussed. 19 refs., 21 figs., 7 tabs.

314 (CRIE-T–87084) **Model study of the effects of wind on ion current density and electric field at the ground level.** Amano, Yuji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 45p. (In Japanese). Order Number DE89901262. Available from NTIS (US Sales Only), PC A03/MF A01.

When wind blows normally across the HVDC transmission line, ion current and electric field at downwind ground level increase remarkably with wind, so that it is important to clarify quantitatively ion current phenomena to estimate these around the HVDC transmission line. This report described the dependency of ion current density and electric field at the ground level on wind speed by installing the model test line of 1/50 scale in a large wind tunnel to elucidate the wind effects at the idealized field. The increase rates of ion current density under unipolar and bipolar arrangement can be normalized by the ratio of wind speed to ion drift velocity at no wind condition. Positive ion current density at ground level is smaller at no wind condition by the influence of negative ion under the bipolar arrangement, but increases much larger than negative ion current density with wind and positive and negative ion current densities become nearly equal with wind increases. Effects of wind on electric field is smaller than that on ion current density. 6 refs., 39 figs., 1 tab.

315 (CRIE-T–87086) **Experimental study of direct lightning hits on power distribution lines.** Yokoyama, Shigeru; Asakawa, Akira. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Oct 1988. 62p. (In Japanese). Order Number DE89901265. Available from NTIS (US Sales Only), PC A04/MF A01.

Direct lightning strike equipment of practical 6.6 kV power distribution lines were installed to experimentally study overvoltage occurring on distribution lines hit by direct lightning and the protection effect of overhead ground lines and surge arresters. The experiment was carried out by improving a large impulse generator and by generating lightning impulses current with 18kA peak value and 2μsecond-wave front. Conditions where lightning impulse current applied to the distribution lines was divided to overhead ground line and was flown into distribution lines by surge arrester discharging, were clarified by measuring current waveforms.Lightning overvoltage occurred in the distribution lines had very short wavetail. Experimental value of lightning impulse wave front resulting flashover was 2.5 to 3 times higher than the design standard value. Lightning arresters and overhead ground wire for 6.6kV showed the considerable protection against direct lightning hits. Therefore it is necessary to study the protection effect of each system against direct lightning hits. 9 refs., 32 figs., 11 tabs.

316 (CRIE-T–87089) **Method for estimating lightning outage rates of transmission lines.** Inoue, Atsuyuki. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan).

Energy and Environment Lab. Sep 1988. 46p. (In Japanese). Order Number DE89901261. Available from NTIS (US Sales Only), PC A03/MF A01.

It is necessary to enable the sufficient study not only for total outages but also for polyphase grounding rate and grounding condition by elevating estimation accuracy for lightning outage rates of transmission lines, to avoid the route interrupting. Method to estimate lightning outage rates of transmission lines, how to apply the method to summer thunderstorms and winter thunderstorms, the sensitivity analysis for various factors affecting the calculation, and the effect some countermeasures were described. The estimation of outage rates was prepared on the basis of Armstrong-Whitehead theory for shielding failure and the tower potential rise method for the tower flashover. Values recommended for summer and winter thunderstorms were shown. The sensitivity analysis for factors affecting the estimation of outage rates was made to clarify the important factors qualitatively. The effect of countermeasures such as reduction of tower footing resistance, decrease of shielding angle, increase of separation between arcing horns, equipment of 3 ground wires, equipment of shield wires under power lines and adoption of unbalanced insulation system, was carried out by comparative study to reduce lightning outages of transmission lines. 17 refs., 20 figs., 11 tabs.

317 (CRIE-T–87092) **Multisolution load flow and index of voltage stability.** Takenaka, Kiyoshi; Nagao, Taiji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Nov 1988. 16p. (In Japanese). Order Number DE89901268. Available from NTIS (US Sales Only), PC A03/MF A01.

Analytical approach to prevent previously large voltage reduction by the imbalance of system construction and deviation of load flow was developed. Apparent power-voltage characteristic of one node-infinite bus system has plus and minus modes and stable system operation for any demand requires plus mode with some margin. The criterion by which distinction can be made between plus and minus mode, was proposed by replacing node to be judged by mode to equivalent circuit. Multisolution of load flow for bulk power systems up tp 1,000 nodes was derived by applying this method. The ratio of load margin up to the maximum transmissible load to maximum load is the voltage stability index which shows the degree of margin. It is necessary to determine the maximum load for bulk power systems to calculate on-line voltage stability index for practical system. The calculating time of the maximum load can be reduced greatly by replacing each node to simple equivalent circuit similar to multisolution of load flow. This approach can provide accurate and precise on-line voltage stability index for much shorter period. 1 ref., 12 figs., 2 tabs.

318 (CRIE-T–87093) **Development of new evaluation method for distribution system reliability.** Yoshimitsu, Tsukasa; Fukutome, Atsushi. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 25p. (In Japanese). Order Number DE89901257. Available from NTIS (US Sales Only), PC A03/MF A01.

To promote measures for the improvement of effective reliability to meet the needs of regions and consumers, it is important not only to improve the average reliability level of each consumer but also to level the regional reliability of consumers. This is the report of a method to predict and evaluate the unified reliability of each section of the whole distribution system. This method has made following predictions possible: prediction of the individual reliability level of each section, prediction of the average value and the critical value of the section reliability of each business unit and the distribution situation in the whole system, and the prediction of effects that the measures for the improvement of reliability such as various technologies to shorten service interruption time exert on the average value of reliability level and the distribution situation. By this method, it is possible to predict correctly and per section of the distribution line the service interruption time, to which the actual condition of operation processes t o restore breakdowns is reflected. 4 refs., 11 figs., 4 tabs.

319 (CRIE-T–87094) **Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour.** Koso, Seiichi; Tanaka, Kazuyuki; Nagao, Taiji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 35p. (In Japanese). Order Number DE89901263. Available from NTIS (US Sales Only), PC A03/MF A01.

To examine power supply cost strictly, developed was an evaluation method which takes into account the basic hourly power generating cost of each power source and also the power transfer cost to each consuming spot. First, normal power flow calculation is conducted, then the items and the power generating cost of each power source are imposed, and lastly the power transfer cost is added. In this way, the power supply cost per spot is obtained. A program which is capable of making continuous hourly serial calculation every hour for as long as a year was developed. This program can calculate with ease the supply interference amount and the reliability on the assumption that the routes are cut in transferring and transforming installations. The power supply cost is cheaper as the spot is nearer the base power source, and it begins to rise at the spot and at the hour where and when the power flow from peak and middle power sources reach. Supply reliability becomes lower as the spot is farther from power sources. For the future increase of power demands, the introduction of dispersed power sources instead of centralized power sources of large capacity will reduce the transfer cost (dispersed power sources have little to do with the adjustment of supply and demand, so it is unnecessary to take into account the cost required for the power adjustment) and make other investments possible, and will improve reliability. 1 refs., 24 figs., 2 tabs.

320 (CRIE-T–87095) **ABWR plant model for power-system operation.** Ichikawa, Tatsumi; Inoue, Toshio; Taniguchi, Haruhito. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 24p. (In Japanese). Order Number DE89901260. Available from NTIS (US Sales Only), PC A03/MF A01.

This report describes a plant model of the advanced BWR (ABWR) plant. The model has been jointly developed by CRIEPI and General Electric Company (GE). This model is designed for combining it with the CRIEPI power system dynamics analysis program and for analysis of power system dynamics considering of ABWR plant response. The components and control systems in the reactor system and the turbine-generator system are modeled simply for suppression of time consuming but reasonably for accurate analysis in use of the model. The plant performances under set point change transients of control systems and a momentary voltage drop in house power system were analyzed using the model and compared with those from the detailed plant dynamics simulation code. The comparisons show that the acceptably small difference between the neutron flux transient result from the developed model and that from the detailed code and also show good agreements in other plant variables between the model and the code. The developed model is verified and is acceptable for its use in power system dynamics analysis. 2 refs., 10 figs., 1 tab.

321 (CRIE-T–87099) **Simulation model for automatic generation control.** Nananara, Toshiya. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Nov 1988. 21p. (In Japanese). Order Number DE89901269. Available from NTIS (US Sales Only), PC A03/MF A01.

Adequate follow-up of power system operation is required along with the increase of share of inflexible nuclear generation which is operated with constant output. For this reason, the simulation model for automatic generation control(AGC) was developed. AGC simulates generation control and response of hydraulic, thermal and nuclear power generators at the central load-dispatching office composed of automatic frequency control(AFC) and economic load-dispatching control(EDC). AFC controls on the basis of frequency and tie-lines load deviation. EDC carries out economic distribution due to the equal increment fuel price law within the condition of minimum imbalance of power generation by the thermal power predictive control. This method allows to analyze the system response to the demand and supply fluctuations when changing conditions for power source constitution and etc.; and demand control theory. Predictive control was effective to eliminate the demand imbalance when load changed suddenly. AFC was especially effective for tie-line load. Further, AFC which controls with 10 second interval, was

remarkably effective to fluctuation of 4 min or more frequency caused by response delay. 5 refs., 13 figs., 5 tabs.

322 (CRIE-T–87116) **Survey of adaptive control theory and its applications.** Eguchi, Masayoshi. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Dec 1988. 66p. (In Japanese). Order Number DE89901270. Available from NTIS (US Sales Only), PC A04/MF A01.

Present situation of adaptive control theory and its application was studied, and its application possibilities to electric system control and future subjects have been clarified with the purpose of improving control effects by altering appropriately the control systems online according to the changes of dynamic responses accompanied with the changes of the operating points of electric systems. On the assumption of ideal conditions, many designing methods have been proposed and they have now been almost completed. These methods have been classified, and their correlations have been systematized so that they might be put to use in the future theoretical studies and application. Researches on the case that ideal conditions are not satisfied have been active these days. Strong points and weak points of these research methods and the future subjects have also been indicated. Some of the research results on the application to unitary plants have been put to practical use. Researches on the application to electric system controls are active nowadays; and as far as the control of local phenomena is concerned, the research results are considered applicable in the present status of theory. Application to the control of a whole electric system is a future research subject. 105 refs., 25 figs., 5 tabs.

323 (CRIE-T–88004) **Study on wave forms of lightning surges and disconnecting switch surges.** Ono, Takao; Matsubara, Koji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 36p. (In Japanese). Order Number DE89901259. Available from NTIS (US Sales Only), PC A03/MF A01.

On lightning surges and disconnecting switch surges which are dominant factors for the insulation design of a power plant and a power substation, the mechanisms and the waveforms were studied. There are cases in which the largest magnitude of lightning surges generate in substations by lightning strokes to other than the first tower. Two kinds of mechanisms were clarified. For three kinds of lightning surge waveforms which are greatly different from each other, the reason why those waveforms generate were analyzed. The waveform and the magnitude of lightning overvoltage in substation, actuation of the arrester, the difference in the circuit configuration, have an influence on the wave forms. A relation between the time when a back-flashover occurs and magnitudes of overvoltages in substations and on power lines was obtained. An analysis of a waveform of disconnecting switch surge which has the largest magnitude shows that a stray capacitance of a circuit breaker with contact opened has great influence on the magnitude of the surge. A fundamental frequency of disconnecting switch surge was estimated. The estimated values agreed with the calculated frequencies of surge. 2 refs., 29 figs.

324 (ECRC/R–2350) **Description of a simple fault locating device - the magnetic strip fault recorder.** Aubrey, D.R.; Jameson, I.; Rose, B.; Sandiford, A.T. Electricity Council Research Centre, Capenhurst (UK). Jun 1989. 18p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

A simple and cheap fault finding device is described that is particularly suitable for the location of intermittent earth faults in 11 kV overhead line pole top equipment. The Magnetic Strip Fault Recorder is the simplest of tape recorders. Its ferromagnetic yoke is placed around an assigned earth conductor and then closed onto a small piece of magnetic film. When current flows through the conductor a permanent recording is made on the film which can be inspected at any time with a magnetic viewer. The viewer holds a suspension of magnetic particles which align with the magnetic pattern on the item being examined to provide a visible display of the magnetic print. For fault finding, recorders can be installed over a wide area for a few weeks thus avoiding the commitment of more expensive devices whose value is in their permanent availability. The main purpose of the report is to describe a G clamp form of this device, but other versions are also included. The basic method can be realised in many physical ways, and new designs can be made for many different applications. (author).

325 (ECRC/R–2373) **Remote location of faulted 11 kV cable sections.** Formby, J.R. Electricity Council Research Centre, Capenhurst (UK). Jul 1989. 48p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

This report describes a technical investigation of the use of the 11 kV cable network as a communication link for performing remote faulted cable section location. Methods of coupling signals to and from 11 kV feeders are investigated and described and their use shown to be readily applicable to existing networks. Results of field trials of a prototype remote faulted cable section location system are presented and described. Results of feeder modelling at frequencies between 5 kHz and 15 kHz and network noise investigations have been used to design a remote faulted cable section location system which derives its transmitter energy from the fault current. The report concludes that a relatively simple, reliable, remote faulted cable section location system using the 11 kV cable as the signalling channel can be introduced. (author).

326 (ECRC/R–2374) **Accelerated life tests on 11 kV and 33 kV MIND paper cables in the laboratory.** Domun, M.K. Electricity Council Research Centre, Capenhurst (UK). Jun 1989. 27p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

The prediction of the remaining life of h.v. cables in service depends on the successful identification, measurement, and interpretation of the important parameters concerned. Only if the partial discharge characteristics from new to failure is known for each type of cable can accurate assessment of the remaining cable life be made. Accelerated life tests on h.v. MIND paper cable samples carried out in the laboratory are described in order to determine the rate of ageing and mechanisms of failure of MIND cables, so that a more effective prediction of remaining life can be made for old installed cables. Tests were carried out in two distinct groups: (a) at three times and four times the rated voltage of 50 Hz. (b) at the rated voltage and 4000 Hz. Details of the partial discharge recording and locating techniques, design of cable terminations and temperature rise measurement are given. The advantages and disadvantages of each ageing technique are discussed as are the particular advantages of hot spot monitoring and compound deterioration (waxing) examination. (UK).

327 (ECRC/R–2375) **Condition monitoring of 132 kv bushings.** Domun, M.K. Electricity Council Research Centre, Capenhurst (UK). Jun 1989. 17p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

An increasing proportion of ageing h.v. plant is reaching its design life and beyond. There are major difficulties associated with condition monitoring of old h.v. plant; these include differences in design and manufacturing details between past and modern plant, and prohibitive costs of large scale testing. This report describes an investigation into means of monitoring the dielectric integrity of bushings of 132kV cable sealing ends using non-destructive techniques. The techniques reviewed are h.v. power supplies, partial discharge recordings, capacitance and loss tangent measurements, dissolved gas analyses and moisture measurements. The correlation of results from oil analyses and high voltage tests provides increased confidence in assessing the dielectric integrity of such plant. (author).

328 (ECRC/R–2376) **Prediction of remaining lives of 132 kV grid transformers.** Domun, M.K. Electricity Council Research Centre, Capenhurst (UK). Jun 1989. 15p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

This report describes a set of diagnostic test methods being evaluated as a means of predicting the remaining lives of 132 kV grid transformers. The methods include measurements of the concentrations of dissolved gases, furfuraldehyde, moisture and acidity, and also electrical measurements of breakdown strength, resistivity, permittivity and loss tangent of oil samples collected from transformers in service. It also describes the high voltage measurements of d.c. resistance, 50 Hz loss tangent and partial discharge characteristics, of the transformer insulation, on site during outage times. Some comments are made concerning the possibility of using simple

portable instruments to rapidly screen transformers while on load. (author).

329 (N–89-18379) **A survey of beam-combining technologies for laser space power transmission.** Kwon, J.H.; Williams, M.D.; Lee, J.H. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Dec 1988. 34p. (NASA-TM–101529;NAS–1.15:101529). Available from NTIS, PC A03/MF A01.

The combination of laser beams holds much promise for obtaining powerful beams. Methods are surveyed for beam combination (coherent and incoherent) and two of them are identified as the most effective means for achieving high power transmission in space. The two methods as applied to laser diode arrays are analyzed, and potentially productive work areas for the advancement of technology are delineated.

330 (N–89-20058, pp. 9) **Development of parallel algorithms for electrical power management in space applications.** Berry, F.C. Louisiana Tech Univ., Ruston, LA (USA). Feb 1989. (NASA-CR–172118-VOL-1;NAS–1.26:172118-VOL-1). In *National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1988, volume 1.* Available from NTIS, PC A09/MF A01.

The application of parallel techniques for electrical power system analysis is discussed. The Newton-Raphson method of load flow analysis was used along with the decomposition-coordination technique to perform load flow analysis. The decomposition-coordination technique enables tasks to be performed in parallel by partitioning the electrical power system into independent local problems. Each independent local problem represents a portion of the total electrical power system on which a loan flow analysis can be performed. The load flow analysis is performed on these partitioned elements by using the Newton-Raphson load flow method. These independent local problems will produce results for voltage and power which can then be passed to the coordinator portion of the solution procedure. The coordinator problem uses the results of the local problems to determine if any correction is needed on the local problems. The coordinator problem is also solved by an iterative method much like the local problem. The iterative method for the coordination problem will also be the Newton-Raphson method. Therefore, each iteration at the coordination level will result in new values for the local problems. The local problems will have to be solved again along with the coordinator problem until some convergence conditions are met.

331 (NISTIR–89-4167) **Research for electric energy systems: An annual report.** Van Brunt, R.J. National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Electronics and Electrical Engineering. Oct 1989. 101p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AI01-87CE34011. Order Number DE90001751. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This is a report of technical progress in four investigations conducted at NIST and supported by the US Department of Energy under Task Order Number 137. The first investigation is concerned with the measurements of electric fields and ions in the vicinity of high-voltage transmission lines and biological exposure facilities. For this investigation, results are reported on evaluations of two methods for measuring ion mobilities at atmospheric pressure and an aspiratory-type ion counter for measuring monopolar charge densities in air. The second investigation is concerned with development of advanced diagnostics for compressed gas-insulated power systems. For this investigation, results are reported on measurements of collisional electron detachment and negative ion conversion reactions in SF_6 and on a new technique for measuring the stochastic behavior of partial discharges. The third investigation is concerned with measurement of prebreakdown phenomena at solid-liquid dielectric interfaces. Results are presented here from optical observations of the influence of hydrostatic pressure on prebreakdown partial discharge development and measurement of nanosecond impulse breakdown at liquid-solid interfaces. The fourth area of research is concerned with electrical measurement of fast transient phenomena. Results are presented from an investigation into the interactions between two dividers used simultaneously to measure fast impulse voltages. 99 refs., 51 figs., 5 tabs.

332 (ORNL/Sub–85-22012/1) **Adaptive protective relaying of transmission power systems for improved reliability.** Oak Ridge National Lab., TN (USA); Electric Research and Management, Inc., State College, PA (USA). Aug 1988. 192p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90000973. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Conceptual, adaptive solutions to many common problems are presented for protective relaying of electrical bulk-power systems with a potential for improved reliability and economy of power systems operation. The relaying would adapt to changes in the power system configuration and loading, and to environmental factors using a hierarchical computer structure for the processing of data and for changing relaying settings and logic. Illustrative hardware and software organizations show means for development, starting within an existing or new substation before linking to remote computers. The study assumes the availability of reliable communications (e.g., fiber optic links). The concepts allow for optional integration with the energy management system (EMS). The fifty-seven concepts were individually developed and then combined within nine hardware organizations (structures) to illustrate where the software would reside and how various routines would interact. In this report the authors focus on the advantages of adaptive relaying and provide a foundation for further development effort. 39 refs., 43 figs., 1 tab.

333 **Tracking harmonic notch filter.** Eno, F. To Department of the Navy, Washington, DC (US). USA Patent 7-326,776. 20 Mar 1989. 15p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

An electronic filter for automatically tracking and removing harmonically related interfering electrical signals such as power-line interference harmonics without attenuating other signals of interest even though the signals are frequency stable and/or near the interference signal frequencies. The filter comprises a very narrow band electronic commutated capacitor-bank comb-notch filter driven by a counter/decoder circuit which is in turn driven by a phase locked loop. The filter also comprises two narrow-band analog filters tuned to the two lowest harmonics of the interfering signal. The summed output of these two filters is applied to the input of the phase-locked loop. The phase-locked loop locks to the proper multiple of the interfering signal and drives the comb notch filter at a frequency which causes it to generate notches at unit multiples of the fundamental of the interference frequency. This action is continuous such that center frequencies of the notches are automatically adjusted to compensate for small variations in the interference frequency.

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 472, 478, 491

334 (DOE/FTR–90001696) **[Production and use of energy from nuclear reactions]: Foreign trip report, July 2–8, 1989.** Takahashi, Hiroshi. Brookhaven National Lab., Upton, NY (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001696. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

New and advanced concepts for the production and use of energy from nuclear reactions, such as inertial confinement fusion, advanced fuel fusion, nuclear space power system, muon catalyzed fusion, new nuclear waste management, and the inherent safe reactor, were discussed in the 5th ICENES 1989 conference. Highlights of the conference that were presented by the foreign countries were the "Safety of Emerging Nuclear System"; and the NET Design; Incineration of Actinide by Proton; New Advances in Inertial Confinement Fusion Beam-Target Nuclear Interactions in Dense Plasma Energy Gains of ICF-Mu-DT Symbiosis; and the experimental work on cold fusion by Indian groups. In a special session on cold fusion, new experimental results involving the large amount of the tritium production were reported by the Director of Phabla Atomic Research Center.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

Refer also to citation(s) 130, 131, 183, 184, 320, 355, 462, 481, 494, 514, 520, 523, 531, 533, 539, 541, 546, 763, 1008

335 (CONF-8909235–2) **Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods.** Chung, H.M. Argonne National Lab., IL (USA). Sep 1989. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Technical committee meeting on fundamental aspects of corrosion of zirconium-based alloys in water reactor environments; Portland, OR (USA); 11-15 Sep 1989. Order Number DE90001439. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Waterside corrosion of the Zircaloy cladding has been examined in high-burnup fuel rods from several BWRs and PWRs, as well as in 3 wt % gadolinia burnable poison rods obtained from a BWR. The corrosion behavior of the high-burnup rods was then correlated with results from a microstructural characterization of the cladding by optical, scanning-electron, and transmission-electron microscopy (OM, SEM, and TEM). OM and SEM examination of the BWR fuel cladding showed both uniform and nodular oxide layers 2 to 45 μm in thickness after burnups of 11 to 30 MWd/kgU. For one of the BWRs, which was operated at 307°C rather than the normal 288°C, a relatively thick (50 to 70 μm) uniform oxide, rather than nodular oxides, was observed after a burnup of 27 to 30 MWd/kgU. TEM characterization revealed a number of microstructural features that occurred in association with the intermetallic precipitates in the cladding metal, apparently as a result of irradiation-induced or -enhanced processes. The BWR rods that exhibited white nodular oxides contained large precipitates (300 to 700 nm in size) that were partially amorphized during service, indicating that a distribution of the large intermetallic precipitates is conductive to nodular oxidation. 23 refs., 9 figs.

336 (EPRI-NP–6447) **Avoiding steam-bubble-collapse-induced water hammers in piping systems.** Chou, Y.; Griffith, P. Electric Power Research Inst., Palo Alto, CA (USA); Massachusetts Inst. of Tech., Cambridge, MA (USA). c Oct 1989. 133p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In terms of the frequency of occurrence, steam bubble collapse in subcooled water is the dominant initiating mechanism for water hammer events in nuclear power plants. Water hammer due to steam bubble collapse occurs when water slug forms in stratified horizontal flow, or when steam bubble is trapped at the end of the pipe. These types of water hammer events have been studied experimentally and analytically in order to develop stability maps showing those combinations of filling velocities and liquid subcooling that cause water hammer and those which don't. In developing the stability maps, experiments with different piping orientations were performed in a low pressure laboratory apparatus. Details of these experiments are described, including piping arrangement, test procedures, and test results. Visual tests using a transparent Lexan pipe are also performed to study the flow regimes accompanying the water hammer events. All analytical models were tested by comparison with the corresponding experimental results. Based on these models, and step-by-step approach for each flow geometry is presented for plant designers and engineers to follow in avoiding water hammer induced by steam bubble collapse when admitting cold water into pipes filled with steam. 37 refs., 54 figs., 2 tabs.

337 (EPRI-NP–6515-M) **Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report.** Beauregard, R.J. Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). c Sep 1989. 16p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A previous EPRI project decontaminated two discharged BWR fuel assemblies using the AP-LOMI and AP-CAN-DECON processes at Commonwealth Edison's Quad-Cities Nuclear Power Site. The two decontaminated assemblies and a third control assembly were shipped to the B&W Hot Cell Facility in Lynchburg, Virginia. The three assemblies were partially disassembled in the hot cells and several rods extracted for nondestructive oxide measurement and visual examination. Various components were removed from the two decontaminated fuel assemblies for destructive examination to search for possible deleterious effects of chemical cleaning. The AP-LOMI process removed essentially all of the crud which normally covers a BWR bundle and channel. The AP-CAN-DECON process removed most of the crud, but left a thin layer on the rods and components in the central region of the bundle between the top and bottom spacer grids. Neither decontamination process appeared to damage the Zircaloy-2 fuel and water rods, or the Zircaloy-4 channels and spacers. An adherent zirconium oxide layer still covered all of the Zircaloy surfaces which were examined. The increase in hydrogen content of the channels and fuel rods was low. The AP-LOMI process did not appear to damage the Inconel X-750 fuel rod expansion springs, spacer lantern springs or channel finger spring. A thin, adherent oxide layer was found on all components.

338 (ORNL–6573) **Thermophoretic transport of particles that act as volumetric heat sources in natural convection flow.** Conklin, J.C.; Krane, R.J. Oak Ridge National Lab., TN (USA). [1989]. 260p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90000966. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

Thesis. Submitted by J.C. Conklin to University of Tennessee, Knoxville, TN.

The natural convection boundary layer with suspended heat generating aerosol particles adjacent to a cooled, isothermal, vertical wall was investigated for the following circumstances: laminar and turbulent flow, large temperature differences between the wall and the fluid, stable thermal stratification far from the wall, and fluid participation in thermal radiation heat transfer. The deposition of aerosol particles by thermophoresis was investigated. A scaling analysis showed the negligible effect inside the boundary layer of the particulate heat source strengths of practical interest. Only the temperature of the fluid far from the wall is affected appreciably by the heat sources. The scaled boundary layer differential equations are transformed to a nonsimilarity form for numerical solution using two different methods. An expression for the ratio of mass transfer to heat transfer coefficients was developed to simplify the computation of thermophoretic particle deposition at the wall for the case of constant temperature conditions far from the wall. Variable thermophysical property effect for the three gases of steam, air, and hydrogen were investigated. A dimensionless ratio of transfer coefficients for large temperature differences and turbulent flow was computed as a product of the laminar constant property results and a ratio of the known thermophysical properties at the wall and far from the wall. An approximation of the laminar constant property results for all three gases is developed in terms of the known wall and fluid temperatures, Prandtl number, and a thermophoretic constant. This allows particle deposition to be computed from a known heat transfer coefficient without explicitly solving the particle conservation equation. 120 refs., 29 figs., 21 tabs.

339 (SAND–88-7111) **Operational data collection and analysis for nuclear plant life extension.** Berg, R.M.; Lewis, J.E.; Skay, S.A.; Bailey, T.L. Sandia National Labs., Albuquerque, NM (USA); Multiple Dynamics Corp., Southfield, MI (USA); Northern States Power Co., Minneapolis, MN (USA). Jun 1989. 192p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90000525. Available from NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

This report defines the nuclear plant operational data required to support plant life extension (PLEX) evaluations. The purpose to this report is to assist utilities in assessing how well their plant data capture and preservation methods match up with data needs for a PLEX program. The report also examines the adequacy of existing industry data bases for PLEX purposes, and provides an in-depth review of the PLEX-critical plant chemistry data. Recommendations are provided for future evaluations of "aging indicators," data base improvements and data collection methods, based on the project findings. 12 refs., 23 figs., 8 tabs.

340 (SAND–89-1739C) **MELCOR analyses of drywell flammability.** Dingman, S.E.; Kelly, J.E. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-891103–13:

Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014132. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The MELCOR computer code, which has been developed at Sandia National Laboratories for the US Nuclear Regulatory Commission as a tool for calculating realistic estimates of severe accident consequences and source terms, has been used to analyze a series of containment issues for station blackout sequences for the Grand Gulf Nuclear Power Plant. The results indicate that there is a limited time interval in which the drywell atmosphere would be flammable, and that this would only occur if the vacuum breaker were to stick open within a narrow time window. If burning does occur during this time, it appears quite likely that it would not pose a threat to the drywell wall. The main conclusion from this study is that the drywell atmosphere is not very likely to be flammable for a station blackout sequence. 1 ref. (S.J.)

341 **LEOPARD on a personal computer.** Lancaster, D.B. *Transactions of the American Nuclear Society (USA),* 57: 19-20 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The LEOPARD code is very widely used to produce four- or two-group cross sections for water reactors. Although it is heavily used it had not been downloaded to the PC. This paper has been written to announce the completion of downloading LEOPARD. LEOPARD can now be run on anything from the early PC to the most advanced 80386 machines. The only requirements are 512 Kbytes of memory (LEOPARD actually only needs 235, but with buffers, 256 Kbytes may not be enough) and two disk rives (preferably, one is a hard drive). The run times for various machines and configurations are summarized. The accuracy of the PC-LEOPARD results are documented.

342 **Use of Axially zoned gadolinia in GE [General Electric Co.] BWR reload fuel.** Savoia, P.J. (General Electric Co., San Jose, CA (USA)); Gardner, K.E. *Transactions of the American Nuclear Society (USA),* 57: 32-33 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

General Electric Company (GE) has used gadolinia as a burnable poison in boiling water reactors (BWRs) since its commercial introduction in 1971. With the introduction of GE's GE8B reload product line, axial gadolinia zoning has been utilized to provide multiple design benefits. The first full reload batch of GE8B fuel began operation in early 1987. As of mid-1988, GE8B reloads have been operated in ten BWRs. These reloads have spanned the range of GE plants from BWR/3 through BWR/6. Of these ten applications, five have been designed for increased burnup, four for longer cycles (up to 2 yr), and three for power uprates of ≈4%. Some plants were able to obtain multiple benefits, such as increased cycle energy and power uprate, or higher burnup and increased energy. Fourteen different GE8B bundle designs were used for these applications, since many applications utilize two-stream loading for additional flexibility. The PSZ was used in 50% of these bundles, the SDZ was used in 64%, both were used in 43%, and neither in 29%. These statistics indicate the broad range of applications provided by the axial gadolinia zoning options available with GE8B. The flexibility to design with any combination of these options, as dictated by the particular application, has helped to make custom bundle design a reality.

343 **Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers.** Skogen, F.B.; Kempf, F.J. *Transactions of the American Nuclear Society (USA),* 57: 36 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Advanced Nuclear Fuels Corporation (ANF) first introduced gadolinia integral burnable absorbers in pressurized water reactors (PWRs) a decade ago. The experience of ANF with gadolinia burnable absorbers include nearly 45,000 gadolinia-bearing fuel rods in ≈7500 assemblies irradiated in 29 reactors: 11 PWRs and 18 boiling water reactors. Predictable neutronic performance and excellent fuel integrity has been achieved by ANF in its supply of gadolinia-bearing fuel for light water reactors. A key benefit of gadolinia as a burnable poison is the broad flexibility it offers to fine-tune core power distributions as function of cycle burnup yielding, for example, maximum low-leakage fuel management benefits without exceeding licensed limits.

344 **Evaluation of ANF fuel failures in oyster creek.** Howe, T.M.; Van Swam, L.F.; Piascik, T.G.; Spence, P.A. *Transactions of the American Nuclear Society (USA),* 57: 88-89 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

During the refueling outrage following cycle-10 operations of Oyster Creek nuclear generating station, fuel sipping identified 47 failed Advance Nuclear Fuels (ANF) fuel assemblies. The failed fuel was an unpressurized 8 x 8 design manufactured by ANF prior to 1980. Subsequent inspection of 46 of these 47 assemblies with the ANF ULTRATEST ultrasonic testing system indicated 104 either failed of suspect fuel rods in 44 assemblies. Two of the assemblies were identified as being sound. Selected fuel rods were removed from three of the assemblies and inspected both visually and with an eddycurrent coil. An evaluation has been performed to determine the cause of the failures. The failures were primarily the result of pellet/cladding interaction (PCI). Detailed analyses of several of the failed fuel rods were performed with ANF's fuel rod modeling code RAMPX2. RAMPX2 includes several state-of-the-art models, including a model describing the formation of fission product deposits called coins on the inside surface of the cladding, a model that accounts for axial PCI, and a trapped fuel stack model. The analyses provided an explanation for the failures.

345 **The impact of team building and leadership development on nuclear plant performance.** Fiedler, P.B.; Long, R.L.; Childress, J.R. *Transactions of the American Nuclear Society (USA),* 57: 63-64 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Within the nuclear utility industry, the pressures of complex technologies, increasing regulations, and critical public scrutiny create a working environment filled with numerous pressures. The difficult nature of the industry puts a premium on effective teamwork, interdepartmental cooperation, and communication skills. A well-conceived and implemented team building and leadership development program can substantially improve the operating performance of a nuclear plant. This paper describes one such implementation effort at GPU Nuclear Corporation and at the Oyster Creek nuclear generating station (OCNGS) over an 18-month period.

346 **Rotating machinery surveillance system reduces plant downtime and radiation exposure.** Bohanick, J.S.; Robinson, J.C.; Allen, J.W. *Transactions of the American Nuclear Society (USA),* 57: 197-198 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A rotating machinery surveillance system (RMSS) was permanently installed at Grand Gulf nuclear station (GGNS) as part of a program sponsored by the US Department of Energy whose goal was to reduce radiation exposure to power plant personnel resulting from the inspection, maintenance, and repair of rotating machinery. The RMSS was installed at GGNS in 1983 to continuously monitor 173 analog vibration signals from proximity probes mounted on 26 machine trains and ~450 process data points via a computer data link. Vibration frequency spectra, i.e., the vibration amplitude versus frequency of vibration, and various characterizations of these spectra are the fundamental data collected by the RMSS for performing machinery diagnostics. The RMSS collects vibration frequency spectra on a daily basis for all the monitored rotating equipment and automatically stores the collected spectra for review by the vibration engineer. Vibration spectra automatically stored by the RMSS fall into categories that include the last normal, alarm, minimum and maximum, past three-day data set, baseline, current, and user-saved spectra. During first and second fuel-cycle operation at GGNS, several significant vibration problems were detected by the RMSS. Two of these are presented in this paper: recirculation pumps and turbine-generator bearing degradation. The total reduction in personnel radiation exposure at GGNS from 1985 to 1987

due to the presence of the RMSS was estimated to be in the range from 49 to 54 person-rem.

347 The influence of fuel cycle duration on nuclear unit performance. Koppe, R.H.; Olson, E.A.J. *Transactions of the American Nuclear Society (USA),* 57: 200-201 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Because of a number of confounding factors, the effect of fuel cycle length on performance can be difficult to discern. A simple-minded correlation of capacity factors (CFs) with cycle length can be misleading. Instead, the authors have investigated the constituent contributors to unit CFs: (a) performance between refuelings, (b) refueling outage lengths, and (c) midcycle planned outages. A number of concluding observations are warranted: (1) Units that performed best have stayed on short cycles largely because there is less to gain by lengthening their cycles. (2) There is an opportunity for all units to improve performance be going to longer cycles, but generally units that characteristically have longer refueling will gain more. (3) A large backfit commitment that will significantly affect the total planned outage time over a given period may reduce the benefit of longer cycles. (4) There is less to gain in terms of performance improvement changing from 18- to 24-month cycle than from a 12- to 18-month cycle. This is particularly true if a mid-cycle outage is required. (5) Other considerations besides unit performance may be very important in a cost/benefit evaluation of the optimum cycle length.

348 Operating plant scorecard: A statistical analysis of plant outage performance. Christopher, T.A. *Transactions of the American Nuclear Society (USA),* 57: 201-202 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The purpose of this paper is to examine the relationship between outage maintenance practices and overall plant performance at domestic nuclear stations with Westinghouse nuclear steam supply systems. While the specific data in this paper reflect only the Westinghouse subset of US nuclear stations, the author feels that the conclusions reached may well be applicable to light water reactor (LWR) systems in general. The trend toward longer fuel cycles at domestic nuclear stations is inevitable from the standpoint of fuel economics and spent-fuel storage considerations. The challenge is to adjust not only maintenance practices but maintenance philosophy as well, so that longer cycle times are not achieved at the expense of unit availability.

349 Mutual incidences of reactor operation and strategies for core refueling. Lewiner, C. *Transactions of the American Nuclear Society (USA),* 57: 203-204 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Organization of Procedures of Nuclear Energy (OPEN) gathers most of the utilities that operate nuclear power plants in Belgium, France, Germany, Italy, Spain, Sweden, and Switzerland. Technical progress in fuel fabrication has led to advanced fuels possessing better neutron performances and able to withstand higher burnups. Thanks to these improvements, considerable savings in the costs of fuel required for electricity generation can be obtained. There are various possibilities for fuel management: (1) reducing the frequency of reload shutdowns and increasing the duration of each cycle (18 months, generally) while unloading the same fraction of the core at each shutdown [one-third of the core for pressurized water reactors (PWRs)]; and (2) maintaining the annual frequency for shutdowns and reducing the fraction of the core unloaded (going, for example, from one-third to one-fourth of the core for the PWRs). In addition, the use of advanced fuels may reduce reactor operating margins. This reduction might have an impact on the operational flexibility required to optimize the electricity generation of the grid. Therefore, there is clearly a technical and economic interaction between nuclear power plant management and strategies for core refueling. These are the mutual incidences that are the subject of the present paper.

350 Economic potential for future water reactors. Delene, J.G. (Oak Ridge National Lab., TN (USA)); Bowers, H.I.; Shapiro, B.H. *Transactions of the American Nuclear Society (USA),* 57: 205-206 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The present state of the nuclear industry is characterized by extended plant construction times and greatly increased craft labor and engineering costs. This is not true for all nuclear plant construction, since there are better experience nuclear plants that have been constructed on time and at a reasonable cost. The adoption of regulatory reform and improvements in construction practices can be expected to reduce the cost of nuclear plant construction to near today's better experience plants. Further cost savings can also be expected through modularization and standardization of nuclear power plants. It is clear that, without improvements in construction and regulation, it will be impossible to ensure the commercial viability of nuclear power in the United States. One task of an ongoing program at the Oak Ridge National Laboratory (ORNL) for the US Department of Energy (DOE) Office of Nuclear Energy has been the analysis of the costs for future nuclear power plant options vis-a-vis the alternatives. This paper summarizes the results of a preliminary analysis of the power generation costs for future water reactors and compares these costs to those for current light water reactor and coal-fired plants.

351 Dosimetry-adjusted reactor physics parameters for pressure vessel neutron exposure assessment. McElroy, W.N.; Kellogg, L.S. *Transactions of the American Nuclear Society (USA),* 57: 223-225 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The ASTM E706 master matrix standard describes a series of 20 American Society for Testing and Materials (ASTM) standard practices, guides, and methods for use in the prediction of neutron-induced changes in light water reactor (LWR) pressure vessel (PV) and support structure steels throughout a PV's service life. Some of these are existing ASTM standards, some are ASTM standards that have been modified, and some are new ASTM standards. These standards are periodically revised to assume their applicability during the 40-yr (32 effective full-power years) design license period for a nuclear power plant. They are now under review by two new ASTM plant life extension task groups: E10.05.11 on physics dosimetry and E10.02.11 on metallurgy. A brief review on the current application of these standards and a discussion of the status of work to verify the accuracy of derived physics-dosimetry parameter values is presented in this paper.

352 The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry. Maerker, R.E. (Oak Ridge National Lab., TN (USA)). *Transactions of the American Nuclear Society (USA),* 57: 225-226 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The LEPRICON (for *L*east-Squares *E*lectric *P*ower *R*esearch *I*nstitute *Con*solidation program) code system has been developed over the past 10 yr to provide a complete analysis of light water reactor (LWR) pressure vessel dosimetry. The system incorporates nine modules. All but one of the modules treat various aspects of neutron transport from the core through the reactor internals to dosimetry locations in the downcomer and/or reactor cavity regions and to critical fluence locations in the pressure vessel. The LEPRICON adjustment module, on the other hand, performs a state-of-the-art least-squares analysis of the results from the transport modules, a procedure often referred to as spectral unfolding or the combining of integral and differential data. In terms of development, the adjustment module alone required ~70% of the total effort, for reasons that soon will become apparent. The results from the LEPRICON system thus represent prior and adjusted fluences in each of 38 groups from 0.1 to 20 MeV, along with their corresponding standard deviations, at critical locations in the pressure vessel. The complete LEPRICON methodology provides a comprehensive and accurate analysis of LWR dosimetry and, as a result, has been recommended as serving the needs of the US Nuclear Regulatory Commission for extended pressure vessel lifetime monitoring.

353 **Application of an industrial gas supply system to a hydrogen water chemistry installation.** Lynch, D.; Kuberka, K.A. *Transactions of the American Nuclear Society (USA),* 57: 250-252 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Equipment for a hydrogen gas supply and an oxygen gas supply was adapted to meet operating safety criteria for a hydrogen water chemistry (HWC) application at a boiling water reactor (BWR) plant. The oxygen and hydrogen gases are supplied by vaporizing cryogenic liquid drawn from storage tanks. Cryogenic storage tanks consist of an inner vessel supported within an outer vessel, with insulation in the space between vessels. The supports and product lines on the inner container are small and flexible for heat transfer and thermal flexibility considerations. Cryogenic storage tank systems inherently have low natural frequencies and must be analyzed for dynamic response to site seismic criteria. Equipment modifications to meet application criteria were made without compromising performance. The guidelines for HWC installations were supplemented by a comprehensive design safety review to assess the equipment safeguards required to control potential product releases.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

Refer also to citation(s) 130, 131, 183, 184, 203, 206, 208, 335, 336, 339, 341, 343, 347, 348, 349, 350, 351, 352, 467, 468, 471, 474, 479, 481, 482, 487, 489, 490, 492, 494, 497, 498, 503, 509, 511, 513, 518, 520, 521, 522, 523, 529, 531, 533, 537, 539, 540, 541, 542, 763, 1008

354 (KWU-R–917/87/001) **PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report.** Umminger, K.; Mandl, R.; Nopper, H. Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1987. 210p. (In German). Contract BMFT 1500 287/A0. Order Number DE90718176. Available from NTIS (US Sales Only), PC A10/MF A01.

As part of the federally subsidized research project 1500 287/A0, the system behavior of a 1300 MWe pressurized water reactor (PWR) was investigated during the depressurization phase (end-of-blowdown, EOB), as well as during the refill and reflood phases of a loss of coolant accident involving a large break in the reactor coolant loop. Appropriate modifications to the system and supplementary instrumentation have made it possible to simulate the EOB (as of 26 bar), the refill phase and reflood phase in sequence. This report includes a detailed description of the instrumentation and the data acquisition system used in Test Series PKL IIB. (orig.) With 6 refs., 2 tabs., 60 figs.

355 (NUREG/CR–5079) **Experimental results pertaining to the performance of thermal igniters.** Carmel, M.K. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology; Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 82p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–87-3139). Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

This report summarizes the results of various experimental programs regarding the performance of thermal igniters for the deliberate ignition of hydrogen in light water reactors. Experiments involving both premixed combustion and combustion with continuous hydrogen injection are reviewed. Combustion characteristics examined include flammability limits of hydrogen:air and hydrogen:air:steam mixtures, combustion pressure rises, combustion completeness, flame speeds, and heat transfer aspects. Comparisons of igniter type and igniter reliability under simulated reactor accident conditions are included. The results of the research programs provide a broad data base covering nearly all aspects of hydrogen combustion related to the performance of deliberate ignition systems.

356 (NUREG/CR–5365) **Iodine speciation and partitioning in PWR steam generator accidents: Final report.** Beahm, E.C.; Daish, S.R.; Hopenfeld, J.; Shockley, W.E.; Voilleque, P. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; Oak Ridge National Lab., TN (USA). Oct 1989. 71p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11168). Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

Measurements of iodine speciation in aqueous solution at 285°C and 1000 psig show a higher percentage as I_2 in solutions at tracer concentrations than at higher concentrations. A 1×10^{-9} M I^- solution resulted in 2% I_2 whereas a 1×10^{-4} M I^- solution had only 0.1% I_2. Tests of primary coolant from operating reactors had a peak in percent I_2 at shutdown, with an increase in volatile species up to 20% of the total iodine. During normal power operation, primary coolant percent I_2 was generally lower than the detection limit. 18 refs., 14 figs., 14 tabs.

357 (PNL-SA–17065) **Thick-film effects in the oxidation and hydriding of zirconium alloys.** Johnson, A.B. Jr. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 31p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909235–1: Technical committee meeting on fundamental aspects of corrosion of zirconium-based alloys in water reactor environments, Portland, OR (USA), 11-15 Sep 1989). Order Number DE90001392. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

One of the fundamental discoveries involving radiation effects on the oxidation of Zircaloy in low-oxygen aqueous environments is the influence of thick oxide films. Zircaloy oxidation rates in low-oxygen (hydrogen-rich) coolants initially proceed at relatively low rates, often almost uninfluenced by radiation. Marked upturns in oxidation rate have signaled the onset of radiation effects. The radiation effects appear to correlate with a threshold oxide thickness. Results of the test reactor experiments lead to formulation of the Thick-Film Hypothesis: beyond a threshold oxide thickness, radiolysis of water that infiltrates oxide cracks and pores controls the oxidation rate; radiation creates microenvironments inside the oxide film, producing highly oxidizing conditions, that are no longer suppressed by the coolant-borne hydrogen. Upturns in oxidation rate on high-exposure Zircaloy pressure tubes add confirmatory evidence for the thick-film effect. This paper summarizes the early evidence for thick-film behavior, including oxidation and hydriding trends, updates confirmatory evidence from Zircaloy reactor and fuel assembly components, and highlights other observations from the test reactor series that have potential fundamental significance to explanations of radiation effects on Zircaloy. 23 refs., 10 figs.

358 **Applications of parallel computer architectures to the real-time simulation of nuclear power systems.** Doster, J.M.; Sills, E.D. *Transactions of the American Nuclear Society (USA),* 57: 23-24 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In this paper the authors report on efforts to utilize parallel computer architectures for the thermal-hydraulic simulation of nuclear power systems and current research efforts toward the development of advanced reactor operator aids and control systems based on this new technology. Many aspects of reactor thermal-hydraulic calculations are inherently parallel, and the computationally intensive portions of these calculations can be effectively implemented on modern computers. Timing studies indicate faster-than-real-time, high-fidelity physics models can be developed when the computational algorithms are designed to take advantage of the computer's architecture. These capabilities allow for the development of novel control systems and advanced reactor operator aids. Coupled with an integral real-time data acquisition system, evolving parallel computer architectures can provide operators and control room designers improved control and protection capabilities. Current research efforts are currently under way in this area.

359 **A Japanese gadolinia fuel usage and demonstration program.** Yokote, Mitsuhiro; Azumi, SS.; Mori, Kazuo; Kobayashi, S.; Nakura, Saburo; Mukai, M. *Transactions of the American Nuclear Society (USA),* 57: 33-35 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Kansai Electric in Japan has begun the large-scale commercial use of gadolinia-bearing fuel. In preparation for this implementation, gadolinia fuel assemblies were designed and licensed, and eight demonstration assemblies were irradiated in cooperation with the fuel vendors Nuclear Fuel Industries (NFI) and Mitsubishi Heavy Industries (MHI). This paper presents an overview of the gadolinia fuel design, the demonstration irradiation, and the postirradiation examination of eight fuel assemblies. Design studies showed that 6 wt% Gd_2O_3 in UO_2 was the optimum in terms of reactivity control capability at the beginning of cycle, peaking factors, residual penalties, and usage experience. The loading of 8 gadolinia fuel assemblies into Mihama No. 1 (two-loop plant) and 32 gadolinia fuel assemblies into both Ohi No. 1 and No. 2 (four-loop plant) is scheduled this year, and more than 100 gadolinia fuel assemblies will be loaded next year. To extend cycle operation even further, a study of up to 10 wt% fuel has been initiated.

360 **The characteristics and effective utilization of a separate burnable absorber.** Spetz, S.W. *Transactions of the American Nuclear Society (USA),* 57: 34-35 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Burnable poisons (BPs) are used in pressurized water reactors to control power distributions and assure acceptable moderator coefficients at beginning of cycle (BOC). There are two basic categories of BPs: the integral poison that is located within the fuel rod and the separate poison that either replaces a fuel rod in the lattice or is located din the control rod guide tubes (thimbles) of the fuel assembly. This paper discusses the Babcock & Wilcox (B&W) Fuel Company's burnable poison rod assembly (BPRA), a separate poison located in the control rod guide tubes. Experience has shown the BPRA to be a highly reliable core component. Aside from a 1978 failure of the mechanical latching device in use at the time, no failures have occurred in more than 14 yr of use. In addition, the highly efficient shuffle schemes made possible by the BPRA have reduced ore requirements by >3% and separative work requirements by >4%.

361 **Achievements in Westinghouse discrete and integral fuel burnable absorber usage.** Kapil, S.K.; Secker, J.R.; Keller, H.W. *Transactions of the American Nuclear Society (USA),* 57: 35-36 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Burnable absorber usage for pressurized water reactor (PWR) reload cores continues to increase as utilities seek improved fuel efficiency and increased plant availability. Extended cycle lengths, increased fuel burnups, and reduced neutron leakage fuel management strategies have contributed to this trend. To help customers meet their core management objectives, Westinghouse has gained extensive experience with the design and manufacture of three burnable absorbers that are compatible with all PWR fuel applications. The Pyrex borosilicate glass burnable absorber and the wet annular burnable absorber (WABA) are discrete absorbers, while the most recently developed absorber, the ZrB_2 integral fuel burnable absorber (IFBA), is contained entirely within the fuel rods. Westinghouse was also the first to demonstrate the use of gadolinia as a PWR burnable absorber; however, its overall performance compared to the ZrB_2 IFBA does not make it a clearly preferred choice for PWR applications. The three burnable absorbers offer different performance characteristics and features. The most appropriate burnable absorber depends on the specific needs of the utility.

362 **Evaluation of erbia as a burnable absorber in a 24-month, low-leakage C-E core.** Beaudreau, J.J.; Jonsson, A.; Shapiro, N.L. *Transactions of the American Nuclear Society (USA),* 57: 36-38 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The trends of increased cycle length (18 months or longer) and improved fuel utilization (low leakage) have resulted in the need to use burnable absorbers extensively in pressurized water reactor reload cores. The movement toward 24-month cycles has increased that need, presenting significant challenges with regard to moderator temperature coefficient (MTC) and power distribution control, thermal margin, reactivity residuals, and burnout rates. This paper presents an evaluation of the use of erbia (Er_2O_3) as an alternative burnable absorber. Pin peaking for the erbia design along with that for a standard B_4C discrete burnable poison design is shown. This comparison shows that the thermal margin gain for erbia is ≈10%. Some of this improvement results from the virtual nondisplacement of fuel; the bulk f the improvement comes from the very low local power peaking that results from the employment of both erbia and enrichment zoning. The erbia and B_4C designs had essentially the same MTC, although the erbia design had a significantly higher soluble boron level.

363 **Total organizational team building at the V.C. Summer Nuclear Station.** Carswell, R.W.; Parks, J.W. *Transactions of the American Nuclear Society (USA),* 57: 64 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The V.C. Summer station of South Carolina Electric and Gas Company began a total organizational team building program in 1985 as one of several methods by which to make overall operational improvements. The team model selected was developed by Carswell & Associated, Inc. The model has been used successfully in a number of nonnuclear applications. This was its first usage in a nuclear power plant. Total organizational team building has had positive results at the V.C. Summer station. The data suggest that including all employees in decision making can assist with increasing efficiency, morale, and safety in a nuclear power plant.

364 **A null-type instrument for on-line boron analysis.** Jaeger, C.A.; Ellis, E.R.; Parkinson, T.F. *Transactions of the American Nuclear Society (USA),* 57: 78 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

One of the most important chemical parameters that must be measured in pressurized water reactors (PWRs) is the boron concentration in the reactor coolant. Many PWRs were supplied with a boronimeter for these analyses that was based on the neutron transmission method. An alternative method used at some plants utilizes the mannitol titration method, which requires grab sampling and is thus poorly suited to on-line analysis. The titration method also has the limitation of responding to the boron elemental concentration, whereas a more significant analysis is for the ^{10}B content. The purpose of this research was to develop a novel null-type boronimeter that is based on the neutron transmission method and incorporates a servo-driven neutron-absorbing sleeve. Thus, the boronimeter operates as a null-type device that is well suited to the on-line determination of boron concentration. A recent study has recommended that enriched boron be used in PWRs; if this practice is adopted, an analytical method is needed that responds to the ^{10}B concentration. The results of this research have demonstrated the principles of a novel null-type boronimeter, which should be useful for rapid, accurate, on-line measurements of boron concentration.

365 **Upgrading radiological work practices through employee participation.** Beckman, W.L. *Transactions of the American Nuclear Society (USA),* 57: 62-63 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Following the shutdown of the Midland Plant in 1984, Consumers Power Company found itself with a need to reorganize its nuclear operations department. The reorganization took place in November 1984. At that time the plant was just completing an intermittent outage that had begun in September 1983. Over the previous 2 yr, the plant had expended 1,500 person-rem and generated 1330 m^3 of radioactive waste. In addition, an overexposure and a shipping violation in early 1984 had contributed to a deteriorating regulatory picture for radiological services. In an attempt to understand the problem confronting the plant, the new organization set up a group of meetings for each department to identify their barriers to becoming a high-performance organization. These meetings, which became known as barrier meetings, were used to identify barriers to performance, such as overly restrictive requirements, excessive paperwork, facility limitations, and improper job assignments. Following the barrier meetings, corrective actions and individuals responsible for completing these actions were identified. Most recent efforts have been in upgrading radiological work practices.

366 Evaluation of advanced computer systems for performing system thermal-hydraulic modeling. Sills, E.D.; Doster, J.M. *Transactions of the American Nuclear Society (USA),* 57: 119-120 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The thermal-hydraulic code FLOC has been developed to investigate the vector and multi-CPU performance of advanced computer systems. The FLOC code solves the area-averaged Navier-Stokes equations using a semi-implicit formulation that produces a linear system in terms of the spatial pressure distribution. This code was written on a VAX and transported to a CRAY X-MP, where it was optimized for vectorization on a single CPU. Subsequently, the code has been transported to an IMB 3090 at Cornell National Supercomputer Center and to an Alliant FX/8 mini supercomputer at Argonne National Laboratory. Several nodalizations have been developed to model a typical Westinghouse four-loop pressurized water reactor.

367 Experience-based classical RCM at Ginna. Owsenek, L.W.; Edgar, E.C. *Transactions of the American Nuclear Society (USA),* 57: 186-187 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Rochester Gas & Electric Company began a comprehensive maintenance improvement program for its Ginna station in early 1985. The program includes all activities and functions related to maintenance and has as its focal point, a plantwide, experience-based, classical reliability-centered maintenance (RCM) program. Although performance of the now nearly 20-year-old plant has been outstanding, aging equipment and rising maintenance burdens pose a serious threat to continued exemplary performance. Ginna's RCM program began with a carefully structured system selection process to focus project resources on those systems most important to continued safe and economical operation. The process began with definition of tangible and intangible system attributes and weighting factors. Each system was then rated separately in a two-step process designed to reduce subjective bias. Twenty systems were selected for study. Additional systems may be added at a later date. The analytical approaches discussed address the identification of failure modes and effects, criticality, and development of RCM tasks to prevent failure for most common system elements. In reality, the depth and focus of the analysis is usually limited to short-term degradation mechanisms or those already experienced, either at Ginna or somewhere else in the industry. To completely address all potential failure mechanisms, additional evaluations are performed specifically for long-term age-related degradation in critical components.

368 Introduction of advanced pressurized water reactors in France. Millot, J.P.; Nigon, M.; Vitton, M. *Transactions of the American Nuclear Society (USA),* 57: 188 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Designed >30 yr ago, pressurized water reactors (PWRs) have evolved well to match the current safety, operating, and economic requirements. The first advanced PWR generation, the N4 reactor, is under construction with 1992 as a target date for commercial operation. The N4 may be considered to be a technological outcome of PWR evolution, providing advances in the fields of safety, man/machine interfaces, and load flexibility. As a step beyond N4, a second advanced PWR generation is presently under definition with, as a main objective, a greater ability to cope with the possible deterioration of the natural uranium market. In 1986, Electricite de France (EdF) launched investigations into the possible characteristics of this advanced PWR, called REP-2000 (PWR-2000: the reactor for the next century). Framatome joined EdF in 1987 but had been working on a new tight-lattice reactor. Main options are due by 1988; preliminary studies will begin and, by 1990, detailed design will proceed with the intent of firm commitments for the first unit by 1995. Commissioning is planned in the early years of the next century. This reactor type should be either an improved version of the N4 reactor or a spectral shift convertible reactor (RCVS). Through research and development efforts, Framatome, Commissariat a l'Energie Atomique (CEA), and EdF are investigating the physics of fuel rod tight lattices including neutronics, thermohydraulics, fuel behavior, and reactor mechanics.

369 The CAD systems for Chooz-B nuclear power plant construction. Bacher, P.; Beltranda, G. *Transactions of the American Nuclear Society (USA),* 57: 193 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A computer-aided design (CAD) integrated system has been set up by the engineering and design departments of Electricite de France and Framatome for the construction of the Chooz nuclear power plant. Such a structure was required due to the development of new microprocessor-based technologies. Indeed, this is the only way to provide consistent mechanical, electrical, and instrumentation and control (I&C) data, and thus achieve high quality. These systems aim at the three following objectives: (1) obtaining consistent information in the various I&C documents; (2) generating high-quality alphanumeric and graphic data; and (3) supplying the event base with expert systems developed to check functional coherency.

370 Leak suppression at steam generator man-, hand-, and eyeholes. Sylvain, C.; Sutz, P.; Gemma, A. *Transactions of the American Nuclear Society (USA),* 57: 198-199 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Plant unavailability associated with primary and secondary holes is approximately the same as that caused by steam generator tube defects, i.e., 0.5%. Problems encountered with steam generator man-, hand-, and eyeholes during plant operation have led Electricite de France (EdF) and Framatome to improve hole seal design and to develop robots for closing and cleaning them. The data base available in France in this field on some 150 steam generators in 900- and 1300-MW(electric) pressurized water reactors (the equivalent of 300 reactor-yr of operation) has been the base of the developments described in this paper. Incidents occurring in operation primarily concern had-and inspection holes located on the steam generator's secondary side. They include four kinds: (1) leakage detected in operation, requiring forced outages, (2) leakage detected during plant restart after a scheduled shutdown and resulting in a restart delay, (3) pitting of seal mating surfaces, not inducing any leakage but jeopardizing subsequent compliance and requiring difficult and costly repairs, and (4) seizing of screws or bolts. New primary and secondary hole stud tightening and maintenance machines help to improve the efficiency of the in-service closing operations. They provide savings of up to 80% on labor, duration of operations, and exposure.

371 Pilot RCM application to the Diablo Canyon main stream system. Groff, C.R.; Beckham, P.E.; Bych, K.H. *Transactions of the American Nuclear Society (USA),* 57: 181-182 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In 1986 Pacific Gas & Electric Company (PG&E) became extremely interested in reliability-centered maintenance (RCM) after the initial review of two successful Electric Power Research Institute sponsored projects. RCM was visualized as a methodology to common sensitize the burgeoning preventive maintenance (PM) program at the Diablo Canyon plant. RCM could further the uses of predictive and condition-monitoring techniques, as well as eliminate maintenance on components whose failures were noncritical. An extensive review of maintenance and operation experience data, in conjunction with plant staff recommendations and a prioritization according to maintenance expenditures and operational/safety significance, produced the selected system: the turbine main steam supply system (main steam). The pilot project segmented the main steam system into eight subsystems to aid in analysis: (a) main steam isolation valves, (b) auxiliary feedwater pump turbine, (c) overpressure protection (steam dump), (d) main feedwater pump turbines, (e) main steam, (f) main turbine, (g) steam blowdown, and (h) moisture separator reheaters. System analysis activities, including the preparation of functional failure analyses, failure modes and effects analyses, and logic model analyses, were conducted in parallel with corrective and preventive maintenance data-gathering

activities to maximize project team personnel participation during the project. Results and lessons learned are summarized.

372 **Modular construction approach for advanced nuclear plants.** Johnson, F.T.; Orr, R.S.; Boudreaux, C.P. *Transactions of the American Nuclear Society (USA),* 57: 191 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Modular construction has been designated as one of the major features of the AP600 program, a small innovative 600-MW (electric) advanced light water reactor (ALWR) that is currently being developed by Westinghouse and its subcontractors. This program is sponsored by the US Department of Energy (DOE) in conjunction with several other DOE and Electric Power Research Institute ALWR programs. Two major objectives of the AP600 program are as follows: (1) to provide a cost of power competitive with other power generation alternatives; and (2) to provide a short construction schedule that can be met with a high degree of certainty. The AP600 plant addresses these objectives by providing a simplified plant design and an optimized plant arrangement that result in a significant reduction in the number and size of systems and components, minimizes the overall building volumes, and consequently reduces the required bulk quantities. However, only by adopting a modular construction approach for the AP600 can the full cost and schedule benefits be realized from the advances made in the plant systems design and plant arrangement. Modularization is instrumental in achieving both of the above objectives, but most of all, a total modularization approach is considered absolutely essential to ensure that an aggressive construction schedule can be met with a high degree of certainty.

373 **Passive containment cooling for an advanced PWR.** Conway, L.E.; Stewart, W.A. *Transactions of the American Nuclear Society (USA),* 57: 191-193 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The AP600 is a 600-MW(electric) pressurized water reactor that is currently being developed by Westinghouse and its subcontractors. The AP600 program is being sponsored by the US Department of Energy (DOE) in conjunction with DOE and Electric Power Research Institute advanced light water reactor programs. The AP600 employs safety features that, when actuated, use natural phenomena and stored energy (gravity, natural circulation, compressed gas) to accomplish all required safety functions. This safety approach results in both improved safety and a significant simplification in the overall plant design since no safety-grade ac power or support systems are required. Also, significant reductions in plant complexity, capital cost, and construction schedule can be achieved. One of the key safety systems in the AP600 passive safety approach is the passive containment cooling system (PCCS). The PCCS provides the safety-grade ultimate heat sink for the removal of reactor-sensible heat and core decay heat following any design-basis event. Analytical models of the PCCS have been developed and transient and accident evaluations have been performed to demonstrate the heat removal capability to the PCCS. These analyses indicate that AP600 postaccident containment response is similar to that achieved with active containment heat removal systems. Also in conjunction with analyses, a test program is under way to demonstrate and verify the heat removal capability of the PCCS design concept.

374 **Automatic reactor protection system tester.** Jahnke, S.; Raimondo, E. *Transactions of the American Nuclear Society (USA),* 57: 199 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In a pressurized water reactor (PWR) plant, the role of protection systems is to continuously monitor reactor physical parameters. If abnormal operating conditions are detected, these systems trigger protective and safeguard actions. On typical 900-MW(electric) PWR units, the reactor protection system consists of more than 30 electrical cabinets per train, i.e., per subsystem part of the safety injection system, each cabinet containing several hundreds of relays. In normal operation, protection systems are on standby. Should one or more of their components fail, this failure could remain undetected. This is why safety authorities require periodic testing of these systems. To eliminate the risk of reactor trip during reactor protection system testing, Framatome has developed a completely automatic tester. Only one technician in the control room is necessary to use this tester, which automatically carries out all the operations previously done manually. For one train, the test lasts only 40 min instead of 10 h. Test sequences are programmed in solid-state memories. The existing relay circuitry of each unit is analyzed beforehand to make any adaptions required by the use of the automatic tester.

375 **Microstructural examination of oxidized spent PWR fuel by transmission electron microscopy.** Thomas, L.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)); Einziger, R.E.; Woodley, R.E. *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 166(3): 243-251 (Aug 1989).

Pressurized-water reactor spent fuel from oxidation tests at 420 to 450 K in air was examined by transmission electron microscopy to determine the mechanism of initial oxidation beyond UO_2. At oxygen/metal ratios to 2.13, the fuel oxidized internally by forming U_4O_9 along grain boundaries and by advancing coherent U_4O_9/UO_2 interfaces into the UO_2 grains. Grain boundary cracking accompanied U_4O_9 formation. the U_4O_9 in irradiated fuel lacked long-range order, but was readily identified by the presence of diffuse extra reflections in electron diffraction. The tendency of spent fuel to internal oxidation is attributed to rapid penetration of oxygen along grain boundaries coated with closely spaced fission gas microbubbles. (orig.).

376 **Nickel electroplating of steam generator tubes (kiss sleeving process).** Michaut, B. *Transactions of the American Nuclear Society (USA),* 57: 246-247 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This process, the nickel electroplating of steam generator tubes, has been jointly developed under a Belgatom (Laborelec) and Framatome agreement with shared experience gained by both companies, industrial applications being under the responsibility of Framatome. Application of the coating in zones where residual stresses or cracks are present prevents contact between the primary water and the tube, which stops the stress corrosion process. In the Doel 2 plant, 91 tubes have been plated since 1985, and different sets of parameters have been used for comparison purposes. Among these tubes, 9 have been preventively plugged because of defective plating, 9 have been pulled out for laboratory examinations, 2 just after plating and 7 after 1 or 2 yr of service. There are 73 plated tubes still in service. From the tests that were performed, it was possible to select an optimized set of parameters guaranteeing the following properties: bridging of existing cracks and good behavior of the coating in relevant zones, good adhesion to the Inconel tube, high ductility, low residual stresses, thermal shock resistance, corrosion resistance, erosion resistance, and low cobalt content. The licensability of this process is being completed. It is based first on the leak-before-break concept to determine the characteristics of the nickel plating, thickness in particular, and second on the inspectability of ultrasonic testing methods.

377 **Improved reactor coolant system overpressure protection using pilot-operated safety.** Gozal, A.; Bonhomme, N.; Le Goas, J.C. *Transactions of the American Nuclear Society (USA),* 57: 248-249 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This new overpressure protection system uses pilot-operated safety valves manufactured by the French Sebim Company. A comparison with the original design is shown. The three safety valves and the three discharge lines, each of which contained a power-operated relief valve, are replaced by three discharge lines, each with a tandem comprising two pilot-operated valves mounted back to back, satisfying the following objectives: (1) total opening and closing reliability, (2) no setpoint drift, (3) smooth operation for any type of discharge flow conditions: undersaturated or saturated water, steam/water mixture or steam, (4) periodic testing simplified, and (5) capability for feed-and bleed operation under postaccident conditions. Forty such systems have been or will be installed or

retrofitted on French pressurized water reactor (PWR) units, plus Tihange 1 and 2 in Belgium, Ulchin 1 and 2 in South Korea, Guangdong in the People's Republic of China, and Beznau 1 and 2 in Switzerland. The remainder of the 56 French PWR units will also be eventually fitted with this system.

378 Flow-assisted corrosion-consequences for piping. Remy, F.N.; Bouchacourt, M.; Bellon, M. *Transactions of the American Nuclear Society (USA),* 57: 249 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

For 2 yr, power plant owners have been aware that damage caused by flow-assisted corrosion (FAC) can be overcome: on the one hand with a proper choice of water chemistry and on the other hand with a proper choice of water chemistry and on the other hand by the use of prediction methods that allow limiting the inspection areas and providing a sure and accurate fitting replacement and pipe surveillance program. To explain the phenomena, Electricite de France uses an analytical approach, made possible by 10 yr of loop tests and the feedback from many operating plants. If the FAC is well known when there is monophasic water flow, with the specific influence of each parameter, it is possible with this development to include the influence of the two-phase flow in the analysis. To predict the lifetime of the piping, it is necessary to take into account all loads that concern the piping's stress field, i.e., internal pressure, weight, and external load. A way is presented to integrate all consequences of the thinning and avoid unpleasant surprises when the lifetime is given with only a pressure stress analysis.

379 Combustion engineering nuclear plant performance trends. Breckenridge, N.J.; Pagen, V.A. *Transactions of the American Nuclear Society (USA),* 57: 202 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Since December 1971, when Palisades entered commercial operation, through 1987, the 14 Combustion Engineering, Inc., nuclear steam supply system (C-E NSSS) plants in commercial operation have produced an aggregate total of >544 million MWh of electrical energy. This amount of energy production is equivalent to one 1100-MW(electric) plant operating continuously at 80% capacity factor for more than 70 yr. This paper reviews recent plant performance trends and provides information on the performance of C-E NSSS plants as a function of fuel cycle length. A limited comparison with other vendors' NSSS is also provided. In evaluating the capacity factor for all C-E NSSS plants over their operating lifetime, excluding initial cycles, the performance trend shows an increase of 2% in capacity factor as the fuel cycle length increases from 12 to 18 months. At the same time it is noted that on the average there is an increasing trend in outage duration with increasing cycle length. However, the amount of this increase is not proportional to the increase in cycle length.

380 Capital costs for future light water reactors with modularization/standardization. Allen, R.E.; Nicodemus, D.O.; Claussen, R.L. *Transactions of the American Nuclear Society (USA),* 57: 206-207 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This work estimates the base construction cost for a pressurized water reactor power (PWR) plant that incorporates modularized construction and follows a standardized approach to design and construction. The results of this work are reported in more detail in the Energy Economic Data Base (EEDB) Phase IX Update (1987) Report, which was funded by the US Department of Energy and administered by the Oak Ridge National Laboratory. In the EEDB Phase IX Update, a PWR6-BE data model was created, based on a two-loop nuclear reactor as compared with the four-loop PWR12-BE and with a net capacity of 587 MW(electric). The PWR12-BE and PWR6-BE data models were modified to incorporate modular construction and a standardized approach to design/construction to generate the improved PWR (IPWR)12 and IPWR6 data models. An approach to modular construction was evaluated in which equipment modules radiate from a backbone of joined piping/electrical modules. The estimated base construction costs and site labor person-hours for the IPWR12 and the IPWR6 are compared with similar values for the PWR12-Be and PWR6-BE.

381 Economic goals for the ALWR and sensitivity to cost parameters. Braun, C.; Allen, R.E. *Transactions of the American Nuclear Society (USA),* 57: 211-213 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The development of top-tier economic goals for the advanced light water reactor (ALWR) and the sensitivity of the result to variation in technology cost parameters are described. The ALWR program represents two parallel and well-coordinated development efforts conducted by the US Department of Energy and Electric Power Research Institute (EPRI). The purpose of the joint program is to develop the design specifications for the future ALWRs to be commercially offered in the United States during the 1990s and to obtain US Nuclear Regulatory Commission design certification for proposed plant designs that fall under the overall guidelines of the program. Two plant types are considered: the evolutionary ALWR, which is a 1300-MW(electric) extension of the current best light water reactor (LWR) offerings, and the passive safety ALWR. The passive safety ALWR represents a more innovative approach to the LWR design at the 600-MW(electric) size range, which offers a greater potential for plant cost reduction through equipment elimination and simplification.

2103 Power Reactors, Non-breeding, Graphite Moderated

Refer also to citation(s) 485, 524, 525, 526, 530, 535, 536, 1437

382 (ORNL/FTR–2933) **[Gas-cooled reactor materials]: Foreign trip report, June 11–16, 1988.** Rittenhouse, P.L. Oak Ridge National Lab., TN (USA). 30 Jun 1988. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001744. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The meeting of the managers of the US/FRG/CH cooperative subprogram on materials for gas-cooled reactors is described and the status of each of the work packages comprising this cooperation is summarized. Four proposals for new areas of cooperative work were developed. Briefings by sponsoring organizations on the status of gas-cooled reactor programs in the FRG are discussed and experimental efforts being conducted at KFA on materials are reviewed.

383 (ORNL/FTR–2941) **[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988.** Kimball, O.F. Oak Ridge National Lab., TN (USA). 8 Jul 1988. 23p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001746. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended the conference, presented a paper entitled "Thermal Stability and Environmental Compatibility of Inconel 617," and chaired a session (Mechanical Properties A). Approximately 45 people from 9 countries participated in this conference. Of the 23 papers presented, 22 focused on various aspects of materials for advanced High-Temperature Gas-Cooled Reactors (HTGRs). The papers were classified into four categories: component design and testing — implications for materials, microstructure and environmental compatibility, mechanical properties, and new alloys and developments. The elevated-temperature mechanical properties data base developed for Alloy 800H and Inconel 617 in the Federal Republic of Germany program is very extensive, especially the data base for creep, low-cycle fatigue, and creep fatigue, and for the effect of exposure at expected service temperatures on mechanical properties. Their understanding of gas/metal interactions (gas corrosion), especially for Alloy 800H and Inconel 617, also is quite impressive. The Kernforschungsanlage-Juelich and the High-Temperature Materials Programme, Poole, England, continue to be the leaders in the field of HTGR gas/metal interactions.

384 (ORNL/FTR–3176) **[Structural design criteria for HTGR reactors]: Foreign trip report, January 29, 1989–February 3, 1989.** Hoffmann, C.L. Oak Ridge National Lab., TN (USA). 10 Feb 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002140. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A general description is provided on the topics discussed at the Workshop on Structural Design Criteria for HTR held January 31–February 1, at KFA. Several of the key topics of discussion at the workshop are highlighted. The results of a meeting to discuss recent progress and current status of tasks in the cooperative program on materials for HTGR's are also presented.

385 (ORNL/FTR–3186) **[Structural design criteria for HTGR reactors]: Foreign trip report, January 28, 1989–February 5, 1989.** Blass, J.J.; Rittenhouse, P.L. Oak Ridge National Lab., TN (USA). 6 Mar 1989. 18p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002143. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A two-day Workshop on Structural Design Criteria for HTR is described and discussions of status and progress in each area of work under the US/FRG/CH Subprogram on HTR materials are summarized. Materials problems being experienced in the Thorium-Hochtemperaturreaktor (THTR) and their probable cause are reviewed.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 519, 534

386 (ORNL/tr–89/43) **Thermodynamic and fluid dynamic experiments for the horizontal cold source of the Grenoble high flux reactor.** Hoffmann, H. Oak Ridge National Lab., TN (USA). [1989]. 20p. Translation source information not available. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001483. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The high flux reactor produces neutrons used in studies of the atomic structure of condensed materials or liquids, of tissues and of viruses. Depending on the problem to be solved, experimenters require neutrons at prescribed speeds that can be produced with moderators at various temperatures. In the high flux D_2O reactor, the neutrons are at a temperature of 330K, speeds of ca. 220 m/s; in the graphite of the "hot source", at ca. 2300 K, ca. 6200 m/s and in the D_2 of the "cold source" at 25 K, ca. 650 m/s. Progress in experimental techniques has increased the demand for cold neutrons. In order to meet this demand a new cold source implanted horizontally in a glove finger is planned. Operation of this cold source is projected to start in 1986. 4 refs., 9 figs.

387 (ORNL/tr–89/44) **Experimental evaluation of the liquid deuterium fill fraction of the horizontal cold source moderating cell.** Hoffmann, H.; Astruc, J.M. Oak Ridge National Lab., TN (USA). [1989]. 57p. Translation of Re 972 N(p) 009, October 1983. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001484. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The fill fraction of the Horizontal Cold Source has been determined using liquid deuterium in models with separate and coaxial tubes. Different geometries of cell outlet tubes have been studied. In order to evaluate the fill fraction, the liquid height has been measured by capacitive and gamma absorption probes as a function of the cell power. The probes were calibrates and their characteristics aligned with thermocouples places in the cell wall. Thus, the reliability of the probes has been verified. The results show that the fill fraction depends on the heating power and decreases when the latter increases; the outlet tube geometry has an influence on the fill fraction; the highest fill fraction was obtained with a cell equipped with a "sieve" outlet tube; the fill fraction is $\geq$80% for a power dissipated in the cell of 3000 W; and the fill fraction is not influenced by geometry of the dimensions of the "gas" pipes connecting the cell to the condenser in the circuit of tests performed. 6 refs., 16 figs.

388 (ORNL/tr–89/45) **Tests on wall temperatures of the moderator cell of the D_2 cold source in equilibrium and transient regimes.** Hoffmann, H. Oak Ridge National Lab., TN (USA). 1989. 57p. Translation of Re 972 N(p) 017, December 1983. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001485. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A second cold source is planned in the high flux reactor inside an available horizontal channel. A volume exceeding 5 liters of liquid D_2 at a temperature of 25 K is required for good moderation. The moderator is near the core in the glove finger 23 cm in diameter and 5 m long. Thermal insulation of the cold structures from the environment is assured by a vacuum (Fig. 1). A facility near the core means a high heat liberation (3000 W) in the moderating cell, two-thirds of which is liberated in the material (aluminum) and one-third in the moderator itself. The moderator must handle the heat transfer. This can only be achieved with cooling by boiling the moderator in the cell which is in a state of saturation (25 K; 1.5 bars). It evaporates under the effect of the power liberated. The vapor is eliminated from the source in a monophase form, or in a diphase form as a mixture of fluid and vapor and then liquefied outside the glove finger in a condenser in a high position, cooled with helium. The condensed fluid then returns into the cell. This D_2 circuit is supposed to operate without pumps according to the principle of a thermisiphon. That is, the density differences in the input and outlet tubes give rise to circulation of the fluid. 6 refs., 24 figs.

389 **CANDU-3: Advances in engineering and construction.** Hart, R.S. *Transactions of the American Nuclear Society (USA)*, 57: 189-190 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Canada deuterium-uranium (CANDU)-3 reactor, with a net electrical output in the range of 450 MW, is the latest and smallest version of the very successful CANDU nuclear power system. A number of demanding design requirements were established at the outset of the CANDU-3 program. These included a 100-yr station design life, the ability to replace, modernize, or rehabilitate any aspect of the station within a 90-day outage, a 94% lifetime capacity factor, and a 30-month construction schedule from first concrete to in-service. To achieve these design requirements, CANDU Integrated Design (CANDID) Engineering and advanced construction methods were adopted. The use of advanced engineering and construction methods has contributed significantly to the CANDU-3 achieving design objectives. This enables CANDU-3 to be economically competitive with both larger nuclear and coal-fired generating plants.

2105 Power Reactors, Breeding

Refer also to citation(s) 118, 466, 476, 516, 517

390 (CONF-890855–59) **Three-dimensional bowing analysis of radial reflector assemblies in advanced LMRS.** Kamal, S.A. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989. Order Number DE90002181. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The near-core radial shield in some advanced liquid metal fast reactors (LMRs) consists of steel reflector assemblies that surround the inner core assemblies followed by shield assemblies that have large volume fraction of boron carbide. The reflector and shield assemblies of these reactors are removable, similar in outer configuration to the inner core assemblies and link the inner assemblies to the outer parts of the core restraint system. An important design goal for these reflector and shield assemblies is to have the longest service life in the core with minimum handling. Extended residence of the reflector assemblies in particular, with the ducts subjected to large neutron flux gradients, could give rise to relatively large differential irradiation-induced swelling strains, duct inelastic deformations and interassembly forces. The purpose of this paper is to assess the effect of extending the residence of reflector assemblies in view of the mechanical design requirements of LMR cores. 6 refs., 7 figs.

391 (CONF-891103–2) **A new balance-of-plant model for the SASSYS-1 LMR systems analysis code.** Briggs, L.L. Argonne National Lab., IL (USA). 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Winter meeting of the American Nuclear Society; San Francisco, CA

(USA); 26-30 Nov 1989. Order Number DE89012390. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A balance-of-plant model has been added to the SASSYS-1 liquid metal reactor systems analysis code. Until this addition, the only waterside component which SASSYS-1 could explicitly model was the water side of a steam generator, with the remainder of the water side represented by boundary conditions on the steam generator. The balance-of-plant model is based on the model used for the sodium side of the plant. It will handle subcooled liquid water, superheated steam, and saturated two-phase fluid. With the exception of heated flow paths in heaters, the model assumes adiabatic conditions along flow paths; this assumption simplifies the solution procedure while introducing very little error for a wide range of reactor plant problems. Only adiabatic flow is discussed in this report. 3 refs., 4 figs.

392 (CONF-891103–35) **Irradiation performance of metallic fuels.** Pahl, R.G.; Lahm, C.E.; Porter, D.L.; Batte, G.L.; Hofman, G.L. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE90001923. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Argonne National Laboratory has been working for the past five years to develop and demonstrate the Integral Fast Reactor (IFR) concept. The concept involves a closed system for fast-reactor power generation and on-site fuel reprocessing, both designed specifically around the use of metallic fuel. The Experimental Breeder Reactor-II (EBR-II) has used metallic fuel for all of its 25-year life. In 1985, tests were begun to examine the irradiation performance of advanced-design metallic fuel systems based on U-Zr or U-Pu-Zr fuels. These tests have demonstrated the viable performance of these fuel systems to high burnup. The initial testing program will be described in this paper. 2 figs.

393 (CONF-891140–2) **An improved steam generator model for the SASSYS code.** Pizzica, P.A. Argonne National Lab., IL (USA). [1989]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Session on thermal-hydraulic aspects of passive safety; San Francisco, CA (USA); 27-30 Nov 1989. Order Number DE89013279. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A new steam generator model has been developed for the SASSYS computer code, which analyzes accident conditions in a liquid metal cooled fast reactor. It has been incorporated into the new SASSYS balance-of-plant model but it can also function on a stand-alone basis. The steam generator can be used in a once-through mode, or a variant of the model can be used as a separate evaporator and a superheater with recirculation loop. The new model provides for an exact steady-state solution as well as the transient calculation. There was a need for a faster and more flexible model than the old steam generator model. The new model provides for more detail with its multi-mode treatment as opposed to the previous model's one node per region approach. Numerical instability problems which were the result of cell-centered spatial differencing, fully explicit time differencing, and the moving boundary treatment of the boiling crisis point in the boiling region have been reduced. This leads to an increase in speed as larger time steps can now be taken. The new model is an improvement in many respects. 2 refs., 3 figs.

394 **A phenomenological model of the classical thermal creep curve.** Cerdan, J.L.; Orechwa, Y. *Transactions of the American Nuclear Society (USA),* 57: 92-94 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the design of reactor core components for operation at high temperatures, as for example the cladding of a fast reactor fuel pin, the degree of thermal creep is integral to establishing many design parameters. The analytic expressions generally used for predicting thermal creep have either one or both the following drawbacks: (a) they treat only the primary and secondary stages; (b) the parameters have little or no physical interpretation. The authors present an expression for thermal creep that overcomes these two drawbacks and is sufficiently simple for routine use, especially for incorporation into computer codes.

395 **Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C.** Grossbeck, M.L. (Oak Ridge National Lab., TN (USA)); Suzuki, M. *Transactions of the American Nuclear Society (USA),* 57: 94-95 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Irradiation creep is an important mechanism of deformation in components exposed to a high neutron flux such as fast breeder reactors and fusion reactors. An important characteristic of irradiation creep is its weak temperature dependence. The recent designs of experimental fusion reactors require high neutron flux exposure to components operating at temperatures below 300°C. The fusion environment is also unique in that a hard neutron spectrum, up to 14.2 MeV, produces significant (n,α) reactions in most common structural materials. This results in formation of high concentrations of helium, ≈12 appm/dpa. This paper describes the results of irradiation creep experiments carried out under simulated fusion irradiation conditions.

396 **The TEX-I real-time expert system, applied to situation assessment for the SNR-300 reactor.** Schmal, N.; Leder, H.J.; Schade, H.J. *Transactions of the American Nuclear Society (USA),* 57: 241-242 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Interatom, a subsidiary company of Siemens, is developing expert systems for the technical domain. These systems are operating in various industrial applications like flexible manufacturing or plant configuration, based on a domain-specific expert system shell, developed by Interatom. Additional projects are focusing on real-time diagnostics, e.g., for nuclear power plants. The authors report in this paper about a diagnosis expert system for the liquid-metal fast breeder reactor SNR-300, which uses new real-time tools, developed within the German TEX-I project (technical expert systems for data interpretation, diagnosis, and process control). The purpose of the system is to support the reactor operators in assessing plant status in real time, based on readings from many sensors. By on-line connection to the process control computer, it can monitor all incoming signal values, check the consistency of data, continuously diagnose the current plant status, detect unusual trends prior to accidents, localize faulty components, and recommended operator response in abnormal conditions. In the present knowledge acquisition and test phase, the expert system is connected to a real-time simulation of the reactor. The simulator is based on a thermohydraulic code for simulation of the transient behavior of temperatures and flow rates in the reactor core, plena, pipes, pumps, valves, intermediate heat exchangers, and cooling components. Additionally, the system's response to an asynchronous operator interaction can be simulated.

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

Refer also to citation(s) 272, 275, 1149, 1150, 1151, 1152

397 (N–89-17941) **Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 1. Objectives, summary results and introduction. Final report.** Wetch, J.R. Space Power, Inc., San Jose, CA (USA). Sep 1988. 40p. (NASA-CR–179614-VOL-1;NAS–1.26:179614-VOL-1;SPI–25-1). Available from NTIS, PC A03/MF A01.

The objective was to determine which reactor, conversion, and radiator technologies would best fulfill future Megawatt Class Nuclear Space Power System Requirements. Specifically, the requirement was 10 megawatts for 5 years of full power operation and 10 years systems life on orbit. A variety of liquid metal and gas cooled reactors, static and dynamic conversion systems, and passive and dynamic radiators were considered. Four concepts were selected for more detailed study. The concepts are: a gas cooled reactor with closed cycle Brayton turbine-alternator conversion with heat pipe and pumped tube-fin heat rejection; a lithium cooled reactor with a free piston Stirling engine-linear alternator and a pumped tube-fin radiator; a lithium cooled reactor with potassium Rankine turbine-alternator and heat pipe radiator; and a lithium cooled incore thermionic static conversion reactor with a heat pipe radiator. The

systems recommended for further development to meet a 10 megawatt long life requirement are the lithium cooled reactor with the K-Rankine conversion and heat pipe radiator, and the lithium cooled incore thermionic reactor with heat pipe radiator.

398 (N–89-18967) **Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 4: Concepts selection, conceptual designs, recommendations.** Wetch, J.R. Space Power, Inc., San Jose, CA (USA). Sep 1988. 111p. (NASA-CR–179614-VOL-4;NAS–1.26:179614-VOL-4;SPI–25-1-VOL-4). Available from NTIS, PC A06/MF A01.

A study was conducted by NASA Lewis Research Center for the Triagency SP-100 program office. The objective was to determine which reactor, conversion and radiator technologies would best fulfill future Megawatt Class Nuclear Space Power System Requirements. The requirement was 10 megawatts for 5 years of full power operation and 10 years system life on orbit. A variety of liquid metal and gas cooled reactors, static and dynamic conversion systems, and passive and dynamic radiators were considered. Four concepts were selected for more detailed study: (1) a gas cooled reactor with closed cycle Brayton turbine-alternator conversion with heatpipe and pumped tube fin rejection, (2) a Lithium cooled reactor with a free piston Stirling engine-linear alternator and a pumped tube-fin radiator,(3) a Lithium cooled reactor with a Potassium Rankine turbine-alternator and heat pipe radiator, and (4) a Lithium cooled incore thermionic static conversion reactor with a heat pipe radiator. The systems recommended for further development to meet a 10 megawatt long life requirement are the Lithium cooled reactor with the K-Rankine conversion and heat pipe radiator, and the Lithium cooled incore thermionic reactor with heat pipe radiator.

399 (N–89-22980) **Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 3, technologies 2: Power conversion. Final report.** Wetch, J.R. Space Power, Inc., San Jose, CA (USA). Sep 1988. 136p. (NASA-CR–179614-VOL-3;NAS–1.26:179614-VOL-3;SPI–25-1-VOL-3). Available from NTIS, PC A07/MF A01.

The major power conversion concepts considered for the Megawatt Class Nuclear Space Power System (MCNSPS) are discussed. These concepts include: (1) Rankine alkali-metal-vapor turbine alternators; (2) in-core thermionic conversion; (3) Brayton gas turbine alternators; and (4) free piston Stirling engine linear alternators. Considerations important to the coupling of these four conversion alternatives to an appropriate nuclear reactor heat source are examined along with the comparative performance characteristics of the combined systems meeting MCNSPS requirements.

400 (N–89-25272) **Space nuclear reactor shields for manned and unmanned applications.** Mckissock, B.I.; Bloomfield, H.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 16p. (NASA-TM–102064;E–4821;NAS–1.15:102064;CONF-8906169–: International Astronautics Federation conference on space power, Cleveland, OH (USA), 5-7 Jun 1989). Available from NTIS, PC A03/MF A01.

Missions which use nuclear reactor power systems require radiation shielding of payload and/or crew areas to predetermined dose rates. Since shielding can become a significant fraction of the total mass of the system, it is of interest to show the effect of various parameters on shield thickness and mass for manned and unmanned applications. Algorithms were developed to give the thicknesses needed if reactor thermal power, separation distances, and dose rates are given as input. The thickness algorithms were combined with models for four different shield geometries to allow tradeoff studies of shield volume and mass for a variety of manned and unmanned missions. Shield design tradeoffs presented in this study include the effects of: higher allowable dose rates; radiation hardened electronics; shorter crew exposure times; shield geometry; distance of the payload and/or crew from the reactor; and changes in the size of the shielded area. Specific NASA missions that were considered in this study include unmanned outer planetary exploration, manned advanced/evolutionary space station, and advanced manned lunar base.

401 (N–89-25282) **CSTI High Capacity Power.** Winter, J.M. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 21p. (NASA-TM–102059;E–4817;NAS–1.15:102059;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A03/MF A01.

The SP-100 program was established in 1983 by DOD, DOE, and NASA as a joint program to develop the technology necessary for space nuclear power systems for military and civil application. During FY-86 and 87, the NASA SP-100 Advanced Technology Program was devised to maintain the momentum of promising technology advancement efforts started during Phase 1 of SP-100 and to strengthen, in key areas, the chances for successful development and growth capability of space nuclear reactor power systems for future space applications. In FY-88, the Advanced Technology Program was incorporated into NASA's new Civil Space Technology Initiative (CSTI). The CSTI Program was established to provide the foundation for technology development in automation and robotics, information, propulsion, and power. The CSTI High Capacity Power Program builds on the technology efforts of the SP-100 program, incorporates the previous NASA SP-100 Advanced Technology project, and provides a bridge to NASA Project Pathfinder. The elements of CSTI High Capacity Power development include Conversion Systems, Thermal Management, Power Management, System Diagnostics, and Environmental Interactions. Technology advancement in all areas, including materials, is required to assure the high reliability and 7 to 10 year lifetime demanded for future space nuclear power systems. The overall program will develop and demonstrate the technology base required to provide a wide range of modular power systems as well as allowing mission independence from solar and orbital attitude requirements. Several recent advancements in CSTI High Capacity power development will be discussed.

402 **Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields.** Zhang, J.G.J.; Anghaie, S. *Transactions of the American Nuclear Society (USA),* 57: 117-118 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The Innovative Nuclear Space Power Institute's proposed closed-cycle gas core reactor (GCR) systems for space power generation utilize gaseous nuclear fuel/working fluids to convert nuclear energy to electricity in a disk magnetohydrodynamic (MHD) generator. The circulating gas comes to critical condition in a cylindrical vessel with Be/BeO as external moderator. The paper shows the schematic of a bimodal GCR system with a disk MHD generator. This paper presents a summary of the research effort to develop a time-dependent computational model for simulation of the flow and heat transfer process in the GCR vessel (the central cavity). In this computational model, the system is divided into two sections at upstream and downstream of the nozzle surface. During steady-state operation of the system, the nozzle is designed to achieve critical flow conditions at the throat section. Results presented in this paper deal with simulation of the flow and heat transfer processes in a region between the core entrance and the nozzle surface using a modified version of the COMMIX-1B computer code. COMMIX-1B is a three-dimensional compressible single-phase computer code for modeling of time-dependent behavior of fluid flow and heat transfer in a variety of reactor systems.

2107 Regulation and Licensing

Refer also to citation(s) 493, 495, 501, 502

403 (NUREG–1385) **Fitness for duty in the nuclear power industry: Responses to implementation questions.** Bush, L.L.; Grimes, B.K. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards. Oct 1989. 14p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

The Nuclear Regulatory Commission published a rule concerning fitness for duty of commercial nuclear power plant workers. This report responds to questions raised concerning the implementation of the rule during the Edison Electric Institute's "Fitness-for-Duty Rule Implementation Workshop." It also responds to questions raised by

licensees with the staff outside the workshop. Publication of this report does not constitute a written interpretation of the meaning of the rule. Only written interpretations by the General Counsel will be recognized to be binding upon the Commission.

2108 Economics

Refer also to citation(s) 339, 430, 431, 433, 434, 435, 436, 463

404 **Reactor operator: Training for the job while earning college credit.** Murdick, S.A. *Transactions of the American Nuclear Society (USA),* 57: 12-13 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The nuclear industry is looking for ways to maximize the dollars spent to train licensed reactor operators and other personnel and, at the same time, upgrade their educational level. The prospects of college credit and/or degree requirements imposed by the US Nuclear Regulatory Commission have provided a significant driving force behind this search. The task is complicated, however, because shift schedules do not permit reactor operators to pursue higher education through the traditional classroom route, and the need for plant-specific training and requalification programs dictate against uniformly adapting college-based courses for training use. The National Program on Noncollegiate Sponsored Instruction (National PONSI) has been of considerable help to the nuclear industry in meeting these challenges. Through its college credit recommendation service, National PONSI has assessed the comparability of certain industry training activities to college-level instruction and has been instrumental in gaining academic recognition of these activities. The program has become a vital means for the industry to achieve its dual mission of preparing employees to successfully perform their jobs and providing them with ways to obtain college degrees in the shortest possible time.

405 **The midwest workshop on preparing nuclear engineering professionals.** Danofsky, R.A.; Rohach, A.F.; Spinrad, B.I.; Nodean, W.C. *Transactions of the American Nuclear Society (USA),* 57: 15-16 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Personnel training and education are activities of major importance for nuclear utilities and represent fruitful areas for possible cooperation between utilities and educational institutions. Utility personnel have a need for continuing education through advanced and undergraduate degree programs and special courses. Nuclear engineering departments are in a position to meet at least some of these needs. The purpose of the workshop described in this paper was to explore ways to increase the dialogue between utilities and universities and to bring faculty and utility personnel together to discuss the educational needs of nuclear utilities. The workshop was held May 25-27, 1988, at Iowa State University. Planning for the workshop was coordinated by a steering committee with representation from the Department of Nuclear Engineering at Iowa State University, Iowa Electric Light and Power Company (IEL & P), and Kirkwood Community College at Cedar Rapids, Iowa. Participants represented nuclear utilities, nuclear engineering departments, 2- and 4-yr colleges, a nuclear training organization, and the Institute of Nuclear Power Operations.

406 **Perturbation, PCs, and the undergraduate.** Lancaster, D.B. *Transactions of the American Nuclear Society (USA),* 57: 16-17 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper has been written to state new objectives in the use of computing power in the classroom. In light of these new objectives, new ground has been broken with regard to the use of adjoints and perturbation analysis in an undergraduate reactor physics course. This paper also presents the current status of Georgia Tech's reactor physics efforts in the transition to the use on new computing power.

407 **Team performance: Pitfalls and solutions.** Lee, R.R.; Eckert, M.J. *Transactions of the American Nuclear Society (USA),* 57: 61-62 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Team building is often used as a focal point and process for improving performance. In many cases these efforts are successful in achieving the desired goals and the team building is confirmed as an effective approach. The authors have been involved in a number of successful, and some unsuccessful, efforts. This paper is concerned primarily with those cases where a team approach did not achieve the desired improvement. These experiences offer an opportunity to better understand the conditions under which team building works and to identify how a complete assessment of the prevailing conditions can provide corrections to improve the probability of success.

408 **Expanding the human-machine interface model to address the effect of leadership and management on performance.** Briant, V.S.; Childress, J.R.; Hannaman, G.W. *Transactions of the American Nuclear Society (USA),* 57: 65-67 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The US nuclear industry now focuses on improving plant performance in measurable areas such as availability, safety, and operations. Risk assessment and pioneering work in human reliability analysis (HRA) have provided methods to identify and prioritize numerous design improvements. Improvements such as control room design, training, and procedures have contributed positively to plant performance. Human performance is increasingly recognized as a fundamental contributor to safe, economic, and reliable operation. Industry leaders suggest that improved leadership and management are keys to enhanced plant performance. This paper identifies several critical aspects of individual and group behavior that, if managed, could significantly contribute to improved performance. Some existing tools for measuring performance are cited.

409 **Improving implementation of corrective actions through a new management consensus process.** Briant, V.S.; Long, R.L. *Transactions of the American Nuclear Society (USA),* 57: 72-73 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

At GPU Nuclear a particular management process is being used to help personnel get over the substantial hump of resistance that lies between written recommendations and effective implementation action. It helps to identify and clarify the desired results when engaging in corrective action. It has also helped to focus discussions with regulators on results (rather than on methods and mechanisms), creating a win-win solution out of a historical impasse on a key safety issue. This paper discusses the origins and use of this consensus-building tool.

410 **Development and application of a new material for control of asiatic clams.** Lyons, L.A.; Austin, D.M.; Post, R.M.; McClellan, E. *Transactions of the American Nuclear Society (USA),* 57: 76-77 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Asiatic-clam-related macrofouling has been estimated to cost US industry more than $1 billion annually. These costs are related flow restrictions, reduced cooling efficiency, maintenance expenses, replacement of damaged equipment, and forced outages. The vulnerability of fire protection systems and safety-related systems in nuclear-fueled generating stations has aroused special concerns. In the spring of 1987, Philadelphia Electric was approached by Betz Laboratories to consider an application of their recently developed molluscicide at the Peach Bottom Atomic Station. The molluscicide was first applied in December 1987 to the high-pressure service water systems. Results are summarized.

411 **Optimal preventive maintenance of a nuclear plant subsystem using dynamic programming.** Harunuzzaman, M.; Aldemir, T. *Transactions of the American Nuclear Society (USA),* 57: 99-100 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Dynamic programming (DP) techniques are powerful tools for solving optimization problems involving nonlinear objective functions

and/or constraints. Although DP algorithms have been utilized for determining optimal system maintenance policies, it is reported that DP may not be computationally feasible for systems with more than four structural units due to the large number of system states that need to be considered. This paper shows the way that a class of maintenance problems can be formulated to reduce the system state space. The approach is illustrated on a nuclear power plant subsystem consisting of six structural units.

412 **Choosing nuclear engineering: A survey of nuclear engineering undergraduates.** Shillenn, J.K.; Klevans, E.H. *Transactions of the American Nuclear Society (USA),* 57: 13-15 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Maintaining a reliable pool of qualified nuclear engineering graduates depends on the ability of nuclear engineering undergraduate programs to recruit students. With the prospect of declining enrollments in nuclear engineering it is important for nuclear engineering programs to know what factors influence students to choose nuclear engineering as an undergraduate major and why they choose a particular undergraduate program. This type of information can be very important to nuclear engineering programs that develop recruiting strategies. To provide some insight into this area, a questionnaire was designed and given to undergraduate nuclear engineering students at Pennsylvania State University. The purpose of the survey was to provide information on the reasons that students picked nuclear engineering as a career and chose to attend Penn State. The questionnaire was given to 27 students in their junior year during the spring semester of 1987 and again to 35 junior students during the spring semester of 1988. There was little difference except as noted between the two groups on their responses to the questionnaire. A partial listing of the survey results is provided.

413 **Studies on the back end of the nuclear fuel cycle.** Spinrad, B.I.; Roglans, J.; Zabunoglu, O.H. *Transactions of the American Nuclear Society (USA),* 57: 57-58 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The authors have performed design and economic studies on the back end of the nuclear fuel cycle under modern conditions in the United States. These conditions are that fuel delivered to the US Department of Energy (DOE) will be long cooled and that light water reactor (LWR) plutonium has value only as a reactor fuel mixed with uranium. This plutonium value is low. First examined were scenarios for receipt and disposal of spent fuel by the DOE. A rate of 2400 tonnes of contained uranium per year per repository was assumed with a first repository being filled in 30 yr. If this begins operation in 2003, with a first-in/firs-out schedule, the fuel received will have cooled 30 yr at first and will still have cooled 15 yr when the repository is closed. Thus, reprocessing would require that the government invest about $770 million to achieve a disposal savings of $440 million. The differential cost of $330 million is a cheap price for the government to pay. At 10% capital charge, which is more than the government pays for capital, annual cost on investment is $33 million. This investment charge, plus operating costs, would yield ≈12,500 kg of fissile plutonium per year and 2300 t per year of uranium, approximately equivalent to natural uranium. The profit from sale of this material could be used to support nuclear energy research.

414 **Turning point in the study of human factors: From centurion to modern man.** Bienvenu, C.; Larchier-Boulanger, J. *Transactions of the American Nuclear Society (USA),* 57: 68-69 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

For many years, it has been traditional to declare the superiority of man over the machine. The notion of man's fragility in confrontation with his machine only emerged slowly, and indeed as a result of a succession of catastrophes. The first of these date back to the railway age (signal errors), while more recent instances are to be found in the fields of aviation (pilot errors) and nuclear power. Increasing attention and in-depth studies have been devoted to the relationship between man and the machine. The following topics are discussed: the ergonomic era, emergence of the group situation, the institutional aspect, and the weight of society.

415 **Research activities in the field of human factors: Evaluation and prospects.** Larchier-Boulanger, J.; Grosdeva, T. *Transactions of the American Nuclear Society (USA),* 57: 69-70 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The industrial systems are sociotechnical i.e., conceived, directed, checked, run, and repaired by individuals belonging to structured organizations for either individual or group work. Hence, a better understanding of how their behavior, competences, and know-how is a must. At the DER and ESF department human factors group is given the mission to enlarge, through a pluridisciplinary approach, the knowledge of human factors in complex systems. Human interventions are analyzed both for their positive aspects (competences and know-how to retrieve complex situations) and their negative aspects (human weaknesses). For safety reasons such analyses are mainly directed toward the nuclear plant operators, considered individually (intervening of one operator) or as a team (group behavior). The aims of the studies on human factors are various, and such studies justify the research in this field. They make it possible, through a better consideration of the variables specific to individuals, to bring to the enterprise means for: (1) increasing reliability and helping performance, (2) improving the adjustment of work demands to the real environment, and (3) creating a better energy between the individual and his/her enterprise. The variables specific to human factors that keep developing thus the perspectives for research, in this field, are to recenter and redefine the undertaken studies.

416 **True-personality-assisted self-awareness expert system.** Laleuf, M. *Transactions of the American Nuclear Society (USA),* 57: 70-71 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Based on psychoanalytic theory, the Who am I? expert system explains in simple terms the individual's true personality, even it its unconscious or hidden aspects. Our overt personality traits are deeply rooted. The Who am I? expert system gives access to an individual's primary personality, starting from his habitual everyday-life behavior: (1) describes the individual's basic personality, (2) explains this personality through the individual's deeply rooted experience and motivation, and (3) makes links with other people with a similar profile. The following are the primary features of the system: easy individual access, results in <20 minutes, and guaranteed confidentiality. Business applications include the following: (1) Individual training: Self-awareness improves a person's ability to fit in and to succeed within the group. (2) Communication: a homogeneous team has a better chance of success. (3) Human reliability: A close-knit team remains reliable even when faced with serious difficulties. (4) Recruitment: This technique enables the selection of individuals who will fit an existing homogeneous team. The system also enables a psychological diagnosis to be confirmed.

417 **Achieving excellence on shift through teamwork.** Newman, L. *Transactions of the American Nuclear Society (USA),* 57: 65 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Anyone familiar with the nuclear industry realizes the importance of operators. Operators can achieve error-free plant operations, i.e., excellence on shift through teamwork. As a shift supervisor (senior reactor operator/shift technical advisor) the author went through the plant's first cycle of operations with no scrams and no equipment damaged by operator error, having since changed roles (and companies) to one of assessing plant operations. This change has provided the opportunity to see objectively the importance of operators working together and of the team building and teamwork that contribute to the shift's success. This paper uses examples to show the effectiveness of working together and outlines steps for building a group of operators into a team.

418 **Optimizing preventive maintenance.** DiCola, F.E. *Transactions of the American Nuclear Society (USA),* 57: 186-187

(1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The traditional approach to preventive maintenance (PM) is based on adherence to manufacturers's requirements and recommended frequencies. When equipment fails, either new procedures are established or the frequency is increased. This leads to an increase in the number of PM activities, overloading not only maintenance resources, but support as well. There is no correlation between more PM and an increase in equipment reliability. More PM may actually induce failures. Reliability-centered maintenance, a new concept in utility maintenance, is based on identifying system/subsystem functions, failures, and dominant failure modes to develop or revise PM tasks. The activities described in this paper are based on actual implementation of this concept on an ongoing project to upgrade the PM program at one of the largest electric utilities in the country. Optimum PM activities are those that, when implemented, will minimize factors that c cause equipment to fail. One technique described illustrates how equipment performance, failure modes, and causes can be related to minimize the occurrence of failures. Operating history and service life of a component are key factors in determining the most effective PM activities, provided that the factors are related to failure modes and causes.

419 Modularization concepts for advanced nuclear power plants. Miller, D.A.; Sigal, G.B. *Transactions of the American Nuclear Society (USA),* 57: 190-191 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Modularization is being planned on a large scale for the next generation of nuclear power plants to reduce cost and construction time. Used successfully in other industries, modularization for nuclear power plants will involve the assembly of large structural modules on-site and smaller tank, equipment, and piping modules off-site. These subjects along with building arrangement are discussed. Modularization may be used to guide the integration of system design, component configuration, and general arrangements for overall optimization.

420 Development of an expert system for signal validation. Qualls, A.L.; Uhrig, R.E.; Upadhyaya, B.R. *Transactions of the American Nuclear Society (USA),* 57: 237-238 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Diagnosis of malfunctions in power plants has traditionally been in the domain of the process operator, who relies on training, experience, and reasoning ability to diagnose faults. The authors describe a method of signal validation using expert system technology, which detects possible anomalies in an instrument channel's output, similar to the procedure used by an operator. The system can be used to scan quickly over an array of sensor outputs and flag those that are observed to have possible anomalies. This system, when implemented in an operating power plant, could be used for continuous, on-line instrument anomaly detection with a minimum of computational effort.

421 Generic cost estimates for retrofit activities at nuclear power plants. Sciacca, F.W.; Simion, G.P.; Feld, S. *Transactions of the American Nuclear Society (USA),* 57: 207-208 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Producing realistic and consistent cost estimates of construction-related activities at nuclear power plants is essential to determine the potential economic impact on the utility, as well as to assist in evaluating economically sound alternatives. Several studies completed recently under the sponsorship of the US Nuclear Regulatory Commission deal specifically with physical modification costs at nuclear plants. The approach developed utilizes median baseline costs for labor, equipment, and materials associated with new plant construction as a starting point. These costs are then adjusted to reflect actual conditions existing at operating or nearly completed nuclear plants. Successive sets of factors are used to estimate the total resource requirement, as well as aspects such as worker radiation exposure. This methodology allows analysts to generate reasonable cost estimates quickly, it requires only a modest amount of user input, and it helps identify and quantify the cost elements involved in retrofit activities. Major cost categories associated with physical modifications at nuclear power plants are illustrated. The generic cost-estimating approach requires the analyst to consider some or all cost aspects depending on the complexity of the retrofit, the size of activity, and other constraints. For comparisons of estimated versus actual costs, ~48 cost data points were obtained. This generic methodology produced cost estimates that, on the average, were within 15% of the actual cost incurred by the utilities.

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 334, 426, 472

2201 Theory and Calculation

Refer also to citation(s) 406, 463, 465, 512, 1836

422 (CONF-891103–18) **Uncertainties associated with the use of the KENO Monte Carlo criticality codes.** Landers, N.F.; Petrie, L.M. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89015903. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The KENO multi-group Monte Carlo criticality codes have earned the reputation of being efficient, user friendly tools especially suited for the analysis of situations commonly encountered in the storage and transportation of fissile materials. Throughout their twenty years of service, a continuing effort has been made to maintain and improve these codes to meet the needs of the nuclear criticality safety community. Foremost among these needs is the knowledge of how to utilize the results safely and effectively. Therefore it is important that code users be aware of uncertainties that may affect their results. These uncertainties originate from approximations in the problem data, methods used to process cross sections, and assumptions, limitations and approximations within the criticality computer code itself. 6 refs., 8 figs., 1 tab.

423 (CONF-891118–4) **Theoretical analysis of reactivity measurement with the ^{252}CF source ratio method.** Difilippo, F.C. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International meeting on nuclear criticality safety margins; San Francisco, CA (USA); 26 Nov - 1 dec 1989. Order Number DE89016164. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Stochastic descriptors are calculated using the concepts of detector field of view and an equivalent source of noise with results that are compatible with a more basic formalism based on a probabilistic analysis of Markovian processes. The model expansion of the detectors fields of view are further used to relate reactivities to observables measured with the ^{252}Cf ratio method. Results from the analysis of experiments are shown together with a numerical analysis of spatial effects. 7 refs., 5 figs.

424 (INIS-BR–1674) **Utilization of ADE method in the numerical resolution of the neutron Kinetic equation.** Santos, R.S. dos. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores. [1989]. 1p. (In Portuguese). Order Number DE90606778. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

425 (INIS-BR–1675) **Two-dimensional suboptimal calibration of the shadow factors in the experimental fast reactor-BR-82.** Jachich, J. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores. [1989]. 1p. (In Portuguese). Order Number DE90606779. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

426 (INIS-SU–10) **Physics and technology of nuclear reactors.** Voprosy Atomnoj Nauki i Tekhniki; (No. 2). Adamov, E.O.

(ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). 1987. 96p. (In Russian). Order Number DE88780094. Available from NTIS (US Sales Only), PC A05/MF A01.

Separate abstracts were prepared for the individual papers in this report. (JDB)

427 (ORNL/tr–89/41) **Horizontal cold source: Experimental cooling tests of the horizontal cold source cell with nitrogen gas.** Hoffman, H. Oak Ridge National Lab., TN (USA). 1989. 31p. Translation of RE 972 N(p) 004, May 1983. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002283. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Heat transfer from the Horizontal Cold Source in service is handled by circulating deuterium by natural convection (thermosiphon). All of the components of the Horizontal Cold Source are placed in a vacuum enclosure that forms an insulation between the cold part and the environment (glove finger, neutron guide). In the event of loss of deuterium circulation (loss of cooling power) the heat produced in the Horizontal Cold Source structures must be removed by: natural convection in the cell and glove finger space, the entire vacuum enclosure filled with He; forced nitrogen convection inside the cell. Calculations show that natural convection is sufficient for heat transfer if the [calculation] codes given are respected. On the other hand, forced nitrogen convection can transport the heat released. In that case, the reactor could remain in service. In order to support these calculations, tests have been performed to determine the quantity of nitrogen required to limit the maximum temperature of the cell wall to less than 200°C. 6 refs., 11 figs.

428 **An experimental study of two-phase natural circulation in an adiabatic flow loop.** Tan, M.J. (Argonne National Lab., Argonne, IL (US)); Ishii, M. pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

An experimental investigation was conducted to study the hydraulic aspect of the phenomena of interruption and resumption of natural circulation, two-phase flow patterns and pattern transitions in the hot legs of prototypical raised-loop reactor systems. The test facility was a scaled 1 X 1 (one hot leg, one cold leg) adiabatic loop designed in accordance with the scaling criteria developed by Kocamustafaogullari and Ishii; the working fluid pair was nitrogen-water. The effects of the variation of the pressure in the steam generators, the variation of friction loss in the cold leg, and the variation of the configuration of the inlet to the hot leg on the flow conditions in the hot leg were investigated by varying the water level in a gas separator, controlling the size of opening of a friction loss control valve, and using two inlet geometries. Methods for estimating the distribution parameter and the average drift velocity are proposed so that they may be used in the application of one-dimensional drift-flux model to the analysis of the interruption and resumption of natural circulation.

429 **The weighted diamond-difference form of nodal transport methods.** Azmy, Y.Y. (Oak Ridge National Lab., TN (USA). Engineering Physics and Mathematics Div.). *Nuclear Science and Engineering (USA),* 98(1): 29-40 (Jan 1988).

Very high computational efficiencies have been achieved recently by introducing higher order approximations to nodal formalisms for the discrete ordinates, neutron transport equation. However, the difficulty of the nodal formalism, its final discrete variable equations, and the solution algorithms have limited the usefulness and applicability of nodal methods in spite of their extremely high accuracy. In this paper general order, general dimensionality nodal transport method cast in a simple, compact, single-weight, weighted diamond-difference form is derived. The new form is a consistently formulated nodal method, which can be solved using either the discrete nodal-transport method or the nodal-equivalent finite difference algorithms without any approximations. The results show that for this problem, the CPU time and the storage size required to achieve a given accuracy decrease monotonically up to order five.

430 **An instructional hydraulic analog of fission product poisoning dynamics.** Voth, M.H. *Transactions of the American Nuclear Society (USA),* 57: 17-19 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Reactor operator trainees frequently have difficulty visualizing fission product poison concentration rate equations and dynamics. A simple hydraulic analog is presented in this paper, which serves as an intermediate step, assisting trainees in understanding the rate equations and visualizing the dynamics.

431 **Application of PCs to a nuclear reactor laboratory course.** Binney, S.E. (Oregon State Univ., Corvallis (USA)). *Transactions of the American Nuclear Society (USA),* 57: 24-25 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Most nuclear engineering curricula contain a nuclear reactor laboratory course. Traditionally these courses involve a tremendous amount of manual data collection and hand processing. With the advent of personal computers (PCs), it is now possible to perform virtually all data collection, storage, and analysis with the aid of a PC. The four 12-bit ADC input ports and a 16-bit input counter of an IBM data acquisition and display adapter (DACA) have been used as an interface between the nuclear reactor and the PC. The DACA is supplied with DOS subroutines (BASIC, C, or FORTRAN) to perform various data manipulations and control functions. Analog input subroutines have been used to measure a set of analog parameters at a user-determined rate, such as for the simultaneous measurement of reactor power and fuel temperature. Adoption of the DACA and its support software has resulted in a significant improvement to the nuclear reactor laboratory course. A considerable amount of time is saved in data taking, and students tend to perform more detailed data analyses. Appearance of laboratory reports has also improved due to the use of word processors and data plotting routines.

432 **Numerical methods: Analytical benchmarking in transport theory.** Ganapol, B.D. (Univ. of Arizona, Tucson (USA)). *Transactions of the American Nuclear Society (USA),* 57: 27 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Numerical methods applied to reactor technology have reached a high degree of maturity. Certainly one- and two-dimensional neutron transport calculations have become routine, with several programs available on personal computer and the most widely used programs adapted to workstation and minicomputer computational environments. With the introduction of massive parallelism and as experience with multitasking increases, even more improvement in the development of transport algorithms can be expected. Benchmarking an algorithm is usually not a very pleasant experience for the code developer. Proper algorithmic verification by benchmarking involves the following considerations: (1) conservation of particles, (2) confirmation of intuitive physical behavior, and (3) reproduction of analytical benchmark results. By using today's computational advantages, new basic numerical methods have been developed that allow a wider class of benchmark problems to be considered.

433 **Collaboration in nuclear engineering education between France and the United States: Research opportunities for US students in France.** Durand, J.L.; Peddicord, K.L.; Davoine, F.; Lemaignan, C.; Destot, M.; Gousty, Y. *Transactions of the American Nuclear Society (USA),* 57: 28 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

As part of a memorandum of agreement between the Department of Nuclear Engineering at Texas A&M University and the Institut National Polytechnique de Grenoble (INPG), opportunities have been made available for students from France and the United States to engage in research and studies at each other's institutions. This paper focuses on the opportunities that have resulted from the memorandum of agreement for US students to study in France. The program in France focuses on the INPG and the Centre d'Etudes Nucleaire de Grenoble (CENG). CENG is one of the principal French research laboratories of the Commissariat a l'Energie Atomique (CEA). At CENG a broad scope of research programs is under

way. Many of these coincide with the interests of faculty members at Texas A & M University. Students from Texas A & M are provided with the opportunity to go to Grenoble to participate in the research programs at CENG. This type of experience should prove valuable in developing engineers with the background to deal with the increasingly international scope of nuclear technology.

434 **Collaboration in nuclear engineering education between France and the United States: Participation of French students at Texas A & M University.** Peddicord, K.L. (Texas A & M Univ., College Station (USA)); Durand, J.L.; Gousty, Y.; Jeneveau, A.; Erdman, C.A. *Transactions of the American Nuclear Society (USA),* 57: 28-29 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Universities in the United States have had a long tradition of accepting students from other countries to pursue graduate degrees. This has particularly been the case in the fields of engineering and science. This trend has grown to the point that in several graduate engineering fields, the percentage of foreign nationals outnumbers US enrollees. Historically, most foreign students studying in the US universities have been from developing countries. Usually these students apply and are accepted on a case-by-case basis. For a number of reasons, less emphasis has been placed on programs with western Europe. In this paper, a program of collaboration is described in which the Department of Nuclear Engineering at Texas A & M University has entered into memoranda of agreement with two institutions in France. The two universities are the Institut National Polytechnique de Grenoble (INPG) in Grenoble and the Ecole Polytechnique Feminine (EPF) in Sceaux. The purpose of the program is to enable students in nuclear engineering to simultaneously complete requirements for the diploma and the MS degree.

435 **The American Nuclear Society's international student exchange program.** Bornstein, I. *Transactions of the American Nuclear Society (USA),* 57: 29 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The American Nuclear Society's (ANS's) International Student Exchange Program sponsors bilateral exchanges of students form graduate schools in American universities with students from graduate schools in France, the Federal Republic of Germany (FRG), and Japan. The program, now in its 12th year, was initiated in response to an inquiry to Argonne National Laboratory (ANL) from the director of the Centre d'Etudes Nucleaires de Saclay proposing to send French nuclear engineering students to the United States for summer jobs. The laboratory was asked to accept two students to work on some nuclear technology activity and ANS was invited to send American students to France on an exchange basis. To date, 200 students have taken part in the program. It has been a maturing and enriching experience for them, and many strong and enduring friendships have been fostered among the participants, many of whom will become future leaders in their countries.

436 **The University of Stuttgart IKE/University of Arizona student research program.** Seale, R.L. (Univ. of Arizona, Tucson (USA)). *Transactions of the American Nuclear Society (USA),* 57: 29-30 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The University of Stuttgart's Institut fuer Kernenergetik und Energiesysteme (IKE) and the University of Arizona have had a joint program in which graduate students from the IKE spend 1 yr on the University of Arizona campus. This program started in 1982 largely as the result of an initiative begun by K.H. Hoecker, then director of IKE. Since 1985, Alfred Voss has been director and the program has continued without interruption. Under the program, the Deutscher Akademisher Austauschdienst, a government agency of the Federal Republic of Germany has funded scholarships for students from IKE, which provide support for 1 yr during which they attend the University of Arizona as visiting student scholars and engage in a research project under the direction of one of our faculty, which satisfies a part of the requirements for the Ingenieur-Diplom Fachrichtung Maschinenbau. The students get credit for their research from the University of Stuttgart. The topics have a broad range and include software development, artificial intelligence, radiation transport, and energy management studies.

437 **Investigation of high-temperature materials for uranium-fluoride-based gas core reactor systems.** Collins, C.; Wang, S.C.P.; Anghaie, S. *Transactions of the American Nuclear Society (USA),* 57: 84-85 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The development of the uranium-fluoride-based gas core reactor (GCR) systems will depend on the availability of wall materials that can survive the severe thermal, chemical, and nuclear environments of these systems. In the GCR system, the fuel/working fluid chemical constituents include enriched uranium fluorides UF_n (n = 1 to 4) and fluorides operating at gas pressures of ≈1 to 100 atm. The peak temperature of the fissioning gas/working fluid in the system can be 4000 K or higher, and the temperatures of the inner surface of the construction wall may exceed 1500 K. Wall materials that can be compatible in this environment must possess high melting points, good resistance to creep and thermal shock, and high resistance to fluorination. Compatible materials that feature high fluorination resistance are those that either do not react with fluorine/fluoride gases or those that can form a protective fluoride scale, which prevents or reduces further attack by the corrosive gas. Because fluorine and fluoride gases are strong oxidizing agents, formation of high melting point protective scales on substrate materials is more likely to be expected. This paper summarizes results of corrosion testing for evaluation of materials compatibility with uranium fluoride. These tests have been carried out by exposing different materials to UF_6 gas in a closed capsule at temperatures up to 1500 K. Past exposure examinations were conducted to determine the morphology and composition of scales that were formed.

438 **Inverse dynamics and the hybrid method of reactivity measurement.** Bernard, J.A. *Transactions of the American Nuclear Society (USA),* 57: 103-104 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Two new algorithms for the measurement of reactivity have been developed. These are inverse dynamics and the hybrid method. The basis of each is the dynamic period equation, which gives the instantaneous reactor period as a function of the rate of change of reactivity, the reactivity, and the rate of redistribution of the delayed neutron precursors. Both methods are rigorous within the limitations of space-independent kinetics. These new algorithms are a recent result of the ongoing Massachusetts Institute of Technology (MIT) program to develop and evaluate advanced instrumentation and control systems for both commercial power and spacecraft reactors. The motivation for this particular effort was the desire to apply validation techniques such as the parity space approach to the estimation of reactivity. Such methodologies require that there be at least three, and preferably four, independent methods of determining the quantity in quantity in question. In regard to reactivity, there have traditionally been only two methods for its measurement. These are balance calculations and inverse kinetics. The research reported here partially addresses the need for additional independent approaches to reactivity measurement in that the new algorithms are mathematically different from the existing inverse kinetics technique.

439 **Hypercube applications of the x-y geometry nodal method for the neutron diffusion equation.** Kirk, B.L. (Oak Ridge National Lab., TN (USA)); Azmy, Y.Y. *Transactions of the American Nuclear Society (USA),* 57: 104-105 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The role that nodal methods play in neutron diffusion theory is highly important. With the advent of high-speed computers, these methods become valuable computational tools. Indeed, implementation of diffusion equation methods on parallel machines has been reported. Solving the one-group neutron diffusion equation by the nodal method requires finding the solution of a system of three equations: the x- and y-current continuity and the conservation equations. This requires matrix inversion. For a very coarse mesh size, the solution may take only a few seconds. As the mesh gets

finer, the system of equations grows in the number of unknowns resulting in a matrix of very high order. On serial computers, matrix inversion is limited by the amount of memory. The CPU time for large systems of equations can also become prohibitive. Thus, a new parallelized iterative algorithm is developed.

440 Synthetic acceleration of one-group S_N k-eigenvalue problems. Adams, M.L. (Lawrence Livermore National Lab., CA (USA)); Larsen, E.W. *Transactions of the American Nuclear Society (USA),* 57: 105-107 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The calculation of k eigenvalues is a fundamental problem in the analysis and design of nuclear reactors and is performed in S_N codes using iteration schemes that converge both k and the eigenfunction ψ. The simplest such scheme, standard power iteration, is always stable, but is also very slowly converging for many problems. Therefore, acceleration methods have been developed to achieve more rapid convergence. The most powerful such method is diffusion synthetic acceleration (DSA), which operates as follows: given estimates for k and the scalar flux ϕ_0, and S_N sweep is performed to determine an estimate of the angular flux ψ. This estimate is used in a diffusion k-eigenvalue problem that has been (nonlinearly) modified so that if the exact S_N solution ϕ were used in it, the exact S_N scalar flux and eigenvalue would be its solution. This diffusion problem is solved for the eigenvalue and scalar flux, and then this updated information is used to start the next iteration. This procedure has the difficulty that because the diffusion equation is altered nonlinearly, every cell-vertex scalar flux that comes out of the transport sweep must be positive; thus a negative flux fixup, which can cause instabilities, must be used. In this paper the authors propose a new DSA-like algorithm for accelerating one-group S_N k-eigenvalue problems that circumvents this difficulty; the essential feature is that modifications to the diffusion equation are linear and are thus indifferent to the presence of zero or negative scalar fluxes.

441 Synthetic acceleration of integral-transport scattering iterations. Lawrence, R.D. *Transactions of the American Nuclear Society (USA),* 57: 107-108 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Recently, synthetic acceleration methods have been developed in which the acceleration equations are derived by using low-order angular (e.g., double P_0) approximations to the angular fluxes on mesh-cell surfaces. These techniques, known as interface current synthetic acceleration or boundary-projection acceleration methods, have been applied to several spatial differencing methods for the multidimensional discrete ordinates equations. In this paper, the authors use a similar approach to develop an acceleration method for the integral transport equations used in the CASMO-3 two-dimensional assembly transport code.

442 Forward versus backward Kolmogorov equations with feedback. Lewins, J.D. (Univ. of Cambridge (England)); Parks, G.T. *Transactions of the American Nuclear Society (USA),* 57: 108-109 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Williams has proposed treating the feedback effects of fuel burnup exactly in a model leading to the forward Kolmogorov equations. In this paper the authors derive the corresponding backward equations and show that, in the generation function, the problem with feedback is nevertheless closed.

443 Numerical solution of the two-dimensional space-time diffusion equations. Chen, G.S.; Yu, J.K. *Transactions of the American Nuclear Society (USA),* 57: 109-110 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In this paper, the authors present some results form the investigation of the application of the von Neumann method to the study of the stability of linear difference equations derived from two dimensional space-time kinetics equations and the application of the block successive overrelaxation (SOR) method with block Gaussian elimination to the solution of linear difference equations, which are solved by Chebyshev acceleration in the TWIGL and BEAGL programs. In this investigation the results of the new program, called TWISOR, were benchmarked against the computational results obtained by the TWIGL program, using the same computing environment and the same sample problems. For all of the problems considered, the TWISOR program provided accurate results in about one-fourth of the time required by the TWIGL program in homogeneous problems and one-half in heterogeneous problems.

444 Computational geometry for reactor applications. Brown, F.B.; Bischoff, F.G. *Transactions of the American Nuclear Society (USA),* 57: 112-113 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Monte Carlo codes for simulating particle transport involve three basic computational sections: a geometry package for locating particles and computing distances to regional boundaries, a physics package for analyzing interactions between particles and problem materials, and an editing package for determining event statistics and overall results. This paper describes the computational geometry methods in RACER, a vectorized Monte Carlo code used for reactor physics analysis, so that comparisons may be made with techniques used in other codes. The principal applications for RACER are eigenvalue calculations and power distributions associated with reactor core physics analysis. Successive batches of neutrons are run until convergence and acceptable confidence intervals are obtained, with typical problems involving $>10^6$ histories. As such, the development of computational geometry methods has emphasized two basic needs: a flexible but compact geometric representation that permits accurate modeling of reactor core details and efficient geometric computation to permit very large numbers of histories to be run. The current geometric capabilities meet these needs effectively, supporting a variety of very large and demanding applications.

445 SABRINA - an interactive geometry modeler for MCNP. West, J.T. (Los Alamos National Lab., NM (USA)); Murphy, J. *Transactions of the American Nuclear Society (USA),* 57: 113-114 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

One of the most difficult tasks when analyzing a complex three-dimensional system with Monte Carlo is geometry model development. SABRINA attempts to make the modeling process more user-friendly and less of an obstacle. It accepts both combinatorial solid bodies and MCNP surfaces and produces MCNP cells. The model development process in SABRINA is highly interactive and gives the user immediate feedback on errors. Users can view their geometry from arbitrary perspectives while the model is under development and interactively find and correct modeling errors. An example of a SABRINA display is shown. It represents a complex three-dimensional shape.

446 Does a point lie inside a polygon. Milgram, M.S. *Transactions of the American Nuclear Society (USA),* 57: 114-115 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A superficially simple problem in computational geometry is that of determining whether a query point P lies in the interior of a polygon if it lies in the polygon's plane. Answering this question is often required when tracking particles in a Monte Carlo program; it is asked frequently and an efficient algorithm is crucial. Littlefield has recently rediscovered Shimrat's algorithm, while in separate works, Wooff, Preparata and Shamos and Mehlhorn, as well as Yamaguchi, give other algorithms. A practical algorithm answering this question when the polygon's plane is skewed in space is not immediately evident from most of these methods. Additionally, all but one fails when two sides extend to infinity (open polygons). In this paper the author review the above methods and present a new, efficient algorithm, valid for all convex polygons, open or closed, and topologically connected in n-dimensional space ($n \geq 2$).

447 A hybrid Monte Carlo method. Hutton, J.L. *Transactions of the American Nuclear Society (USA),* 57: 116-117 (1988).

(CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A method has been developed that combines the best features of deterministic and Monte Carlo techniques. Based on perturbation theory, this new method uses a deterministic solution of a simplified model along with a Monte Carlo calculation of the perturbation linking the simplified model to the actual complex geometry of the problem. If the perturbation is small, then the speed will be increased relative to a conventional Monte Carlo. A computer code MAX has been written, and the results of a range of lattice cell calculations are outlined that illustrate both the accuracy and efficiency of this technique.

448 **Dynamic analysis of heated channels with time-dependent inlet temperature, heat flux, and pressure drop.** Rizwan-uddin; Dorning, J.J. *Transactions of the American Nuclear Society (USA),* 57: 120-122 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Most previous stability analyses of two-phase flow in heated channels were restricted to the case in which total pressure drop, inlet temperature or enthalpy, and heat flux are constant in time. Linear (analytical) analyses for this case resulted in the determination of marginal stability boundaries (MSBs) in parameter space. Nonlinear asymptotic analyses showed that in most cases of practical interest supercritical Hopf bifurcation occurs resulting in stable limit cycles in the linearly unstable region, and numerical analyses of the dynamics equations showed the dependence of the limit cycle amplitude on the distance of the operating point from the MSB. Numerical analyses also have been carried out for time-dependent total (external) pressure drop and for various initial conditions. Some of these analytical and numerical analyses were carried out by first reducing the sets of partial differential equations (PDEs) for the single- and two-phase regions to a set of two coupled nonlinear integroordinary differential equations (ODEs) by integrating along the characteristics and along the channel length. This analytical reduction from PDEs to ODEs, before solving the problem numerically, greatly reduces the magnitude of the computations required. Hence, a similar analytical preprocessing of the basic equations is desirable for the more general case treated here in which total pressure drop, inlet temperature, and heat flux all can vary with time.

449 **Acceleration of energy iterations in thermal-hydraulic calculations.** Gelbard, E.M.; Blomquist, R.N.; Hoffmann, J. *Transactions of the American Nuclear Society (USA),* 57: 122-124 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the typical multidimensional thermal-hydraulic code COMMIX, large matrix equations are solved for pressure and enthalpy. The pressure equations can usually be symmetrized, while the energy equation cannot. Therefore, the pressure equation can be solved by some very sophisticated methods that are not applicable to the energy equation; e.g., the pressure equation can be treated by the conjugate gradient (CG) method, which tends to be helpful in difficult cases, while the energy equation cannot. Generalizations of the CG method, applicable to matrix equations that are not symmetric, are discussed elsewhere. In preliminary work, many of these have been tested on the energy equation, but none has proven as effective as the one to be reported here. The proposed method is similar to, apparently not identically the same as, Axelsson's method with preconditioning; therefore it is called the modified Axelsson method (MAM).

450 **Assessment of the nearly implicit solution scheme of RELAP5/MOD2: Numerical viscosity and suppression of oscillations.** Analytis, G.Th. *Transactions of the American Nuclear Society (USA),* 57: 124-125 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The nearly implicit hydrodynamic solution scheme of RELAP5/MOD2, which allows the code to run at time steps higher (for transients, 5 times) than the Courant limit was partly assessed with a low flooding rate reflooding experiment in the Neptune test facility. It is shown that for a large user-specified maximum time step, instabilities start appearing, which persist even after adding numerical viscosity terms (as is done in the semi-implicit scheme). Finally, it is shown that by linearization of the phasic velocity-dependent interfacial shear term, the instabilities are suppressed even if the (code-inherent) maximum time-step limit is increased to 10 times the Courant limit.

451 **Transient analysis method for two-dimensional discharge flow using a two-fluid model.** Minato, Akihiko; Murata, Shigeto. *Transactions of the American Nuclear Society (USA),* 57: 125-126 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Recent advancements in reactor safety analysis require more detailed predictions of two-phase flow behavior. Therefore, a transient calculation method has been developed for two-dimensional two-phase flow using the two-fluid model. This method treats non-equilibrium two-phase flows by solving the partial differential equations of mass, momentum, and energy balances for each phase. With the finite difference method, which is widely used for two-phase flow analysis, difficulties are incurred when the finite difference of gas velocity is calculated between a node with two-phase mixture and one with single-phase water and no gas velocity. The present method employs the control volume formulation in order to avoid this difficulty and it is designed to simulate local two-dimensional two-phase flow dynamics. The objective of this paper is to outline the fundamentals of the numerical calculation method and its capability of calculating two-dimensional discharge flow from a pipe. This calculation technique is able to treat effects of flow contraction at the pipe inlet and flow expansion at the exit upon discharge.

2202 Components and Accessories

Refer also to citation(s) 411, 437, 466, 469, 483, 496, 508, 510, 539, 1089

452 (WHC-SA–0663) **Guidance on the use of fixed neutron absorbers.** Toffer, H. Westinghouse Hanford Co., Richland, WA (USA). Jun 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-891118–6: International meeting on nuclear criticality safety margins, San Francisco, CA (USA), 26 Nov - 1 dec 1989). Order Number DE89015579. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The paper discusses guidance on the use of fixed neutron absorbers, in specific, recent efforts in developing a standard, "Use of Fixed Neutron Absorbers in the Design of Nuclear Facilities Outside Reactors." The inherent benefits of fixed neutron absorbers are described, the contents of the standard are explained, and the use of fixed absorber applied to the N Reactor fuel storage basin is used as an illustration. The availability of the new standard, the evolution in high-speed computational techniques, and the additional data available measuring the impacts of fixed absorbers should contribute to the more extensive use of this control method in the future. 7 refs., 1 fig.

453 **Stress-driven flow of impurities and its implications for embrittlement of structural components in nuclear applications.** Stubbins, J.F.; Ougouag, A.M.; Williams, J.G. *Transactions of the American Nuclear Society (USA),* 57: 85-86 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Embrittlement of load-carrying components in nuclear applications is reason for concern. While components are fabricated from materials that have sufficient initial ductility, service conditions can degrade materials properties, sometimes leading to embrittlement. A drop in ductility is associated with a lowering of the material fracture toughness, that is, a lowering of the resistance to crack growth. This problem has been investigated in detail for the case of nuclear pressure vessel steels and is also of concern for other nuclear components. A means of assessing the amount of embrittlement due to the collection or rejection of various types of solute atoms near a

crack tip or other stress field has been developed. The model can incorporate the effects of radiation enhancement in the embrittlement process by alteration of the relevant materials parameter. The effects of radiation enhancement are found to be significant.

454 **Radiation effects on power cables for nuclear power plants.** Arora, R.; Munshi, P.; Badshah, M.G.Q. *Transactions of the American Nuclear Society (USA),* 57: 91-92 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A large number of power and control cables, insulated with organic/polymeric materials, are installed quite near the reactor in nuclear power plants. The reliability of electrical equipment, receiving power through these cables, is critically important for the design and safety of the power stations. The radiation intensity inside the containment varies significantly from one location to another. The extent of material degradation is associated with the local radiation intensity. The cables used in the nuclear environment require several unique properties, the most obvious of these being radiation resistance, fire resistance, and the ability to withstand the loss-of-coolant accident in a nuclear power plant as specified in Institute of Electrical and Electronics Engineers (IEEE) Standard 383. In this study, four specific electrical power cable samples insulated with polyethylene, polyvinyl chloride, ethylene propylene rubber, and silicone rubber were chosen to investigate the effect of radiation in reactor environments on the electrical properties of the samples. Voltage breakdown tests and dielectric loss factor (tan δ) and conductor resistance measurements were carried out on each sample before and after irradiating them to near lifetime doses at ambient temperatures in atmospheric conditions.

455 **Development and assessment of an AI expert system for the monitoring and diagnosis of nuclear power plants.** Takeuchi, K.; Gagnon, A.; Cheung, A.C.; Meyer, P.E. *Transactions of the American Nuclear Society (USA),* 57: 242-245 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Due to the rapid progress in microcomputer and software development, artificial intelligence (AI) expert systems of practical value can be built into microcomputers. An expert system for nuclear plant surveillance, diagnostics, and prognostics was developed using the Texas Instruments AI shell, Personal Consultant Plus (PC-plus) on an IBM PCAT. This expert system runs in a surveillance mode to find an abnormal operating condition. Once an abnormal behavior is found,it switches to a diagnostics mode to identify the cause of difficult, such as steam generator tube rupture (SGTR) and leak. Then, the prognostics mode can be activated to predict the consequences. For this purpose, the knowledge of experts at Westinghouse for nuclear safety has been collected and processed to construct parameters and rules within the framework of a logic tree. The expert system may be used in an on-line mode via a connection to the plant computer, safety parameter display system, or a plant simulator. In addition to evaluating the diagnosis of an event and providing appropriate information required to generate an event report, this tool can also be used to review the normal recorded plant data daily to assure that no abnormal events have occurred. A limited assessment of the expert system was performed and is presented.

456 **Near-wall fluid jet velocity profile measurements using laser speckle velocimetry.** Hild, R.D. (Texas A & M Univ., College Station (USA)); Hassan, Y.A.; Cochran, B. *Transactions of the American Nuclear Society (USA),* 57: 249-250 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Cavitation damage has long been known to be the result of the impulsive pressure forces that occur with the collapse of bubbles. It has been hypothesized that a major contributor to cavitation damage is the jet of water resulting from the bubble's collapse impinging on a hairline crack or other imperfection in an otherwise solid surface. If the velocity profile near such cracks could be measured accurately, a better understanding of the forces that are active in this region would be obtainable. Velocities at distances of tens to hundreds of microns from the surface must be measured. The intention of this study is to measure near-wall velocity profiles immediately following bubble collapse. The technique used in these measurements is called laser speckle velocimetry (LSV). In LSV a thin sheet of pulsed laser light is passed through a transparent fluid medium. A suitably chosen (neutrally buoyant) seed material reflects the laser light, usually at 90 deg, and the scattered light is captured on film. A second pulse is sent through a short time later, and the reflected light is captured on the same piece of film. The end result of these two pulses is a doubly exposed film, which is then analyzed by a variety of methods to correlate the images into pairs of points. From this, the fluid's velocity profile is determined.

2203 Fuel Elements

Refer also to citation(s) 475, 510

457 (LA-UR–89-2418) **Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique.** Spriggs, G.D.; Hansen, G.E.; Martin, E.R.; Plassmann, E.A.; Pederson, R.A.; Schlesser, J.A.; Krawczyk, T.L.; Tanner, J.E.; Smolen, G.R. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891103–22: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89015256. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Subcritical measurements of the WINCO slab tank using the source-jerk technique are presented. This technique determines subcriticality by analyzing the transient response produced by the sudden removal of an extraneous neutron source (i.e., a source jerk). We have found that the technique can provide an accurate means of measuring k in configurations that are close to critical (i.e., $0.90 < k < 1.0$). As the system becomes more subcritical (i.e., $k < 0.90$), spatial effects introduce significant biases depending on the source and detector positions. A comparison between the measurements and Monte Carlo code calculations is also presented. 15 refs., 6 figs., 2 tabs.

2204 Control Systems

Refer also to citation(s) 429, 508, 1103, 1136, 1138, 1139, 1140, 1913, 1975, 1976, 2005

458 (WHC-SA–0639) **Computer-controlled flux monitoring using high-density, self-powered incore detectors.** Crowe, R.D.; Samuel, T.J. Westinghouse Hanford Co., Richland, WA (USA). Nov 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-891192–15: Annual Westinghouse computer symposium, Pittsburgh, PA (USA), 6-7 Nov 1989). Order Number DE90001127. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The paper describes the integration of computer hardware and software to automate the operation of an advanced incore neutron monitoring system installed in the DOE's Hanford Site N Reactor. The system, which is unique in the nuclear industry, will use a system of networked computers to automatically record data from 640 self-powered detectors positioned throughout the reactor core. Selected detectors will be monitored at 10 times per second, providing real-time indication of the reactor condition for the operators and detailed core performance data for later offline analysis. The data acquisition computer coordinates the transfer of acquired data for graphic display of flux information, deconvolutes and converts detector currents to flux and power levels, and records and stores data from the movable detector system. This system, supplied by Babcock & Wilcox, represents the present level of technology in reactor flux monitoring and associated data acquisition. It performs several competing tasks simultaneously requiring significant multitasking capability. The demands placed on the central processor by this flux monitoring application will be presented. 2 refs., 5 figs.

459 **A nuclear reactor alarm display system utilizing AI techniques for alarm filtering.** Corsberg, D. (Idaho National Engineering Lab., Idaho Falls, ID (US)); Johnson, L. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American

Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

A control room upgrade is currently being performed at the Advanced Test Reactor (ATR) at the Idaho National Engineering Laboratory (INEL). As part of the control room upgrade, an improved alarm monitoring and display system is being installed. This system consists of completely redundant termination boards, sequential events recorders (SERs), and fiber optic serial alarm transmission from the SERs to the window panels and to host computers. The knowledge-based Alarm Filtering System (AFS) is an integral part of the new monitoring and display system. AFS aids operators by focusing attention on the most significant information relative to the current plant state.

460 **ATHENA AIDE.** Fink, R.K. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)); Callow, R.A.; Larson, T.K.; Ransom, V.H. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

An expert system called the ATHENA AIDE that assists in the preparation of input models for the ATHENA thermal-hydraulics code has been developed by researchers at the Idaho National Engineering Laboratory. The ATHENA AIDE uses a menu driven graphics interface and rule-based and object-oriented programming techniques to assist users of the ATHENA code in performing the tasks involved in preparing the card image input files required to run ATHENA calculations. The ATENA AIDE was developed and currently runs on single-user Xerox artificial intelligence workstations. Experience has shown that the intelligent modeling environment provided by the ATHENA AIDE expert system helps ease the modeling task by relieving the analyst of many mundane, repetitive, and error prone procedures involved in the construction of an input model. This reduces errors in the resulting models, helps promote standardized modeling practices, and allows models to be constructed more quickly than was previously possible.

461 **A computerized experiment for comparison between methods of uncertainty propagation.** Arueti, S. (Mechanical, Aerospace, and Nuclear Engineering Dept., Los Angeles, CA (US)). pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

This paper addresses how the CF model is inappropriate for calculations in engineering or in complex systems. One of its drawbacks is that the results are less accurate than those of BM model in all cases. But even more important is that while additional evidence (e.g. larger numbers of symptoms or more symptoms per cause) always improves the results created by BM, the effect is very often the opposite on CF. The CF method can be viewed as a method which introduces noise with each additional input, which accumulates and eventually confuses the results carried by the input signals. CF is especially sensitive to spurious symptoms, since it does not have a mechanism for reducing either MD or MB. This feature is inherent to the assumption that belief and disbelief are two independent parameters that can be carried out separately in the calculations.

462 **Utilization of simulation data for control system reliability analysis.** Hassan, M.; Aldemir, T. *Transactions of the American Nuclear Society (USA),* 57: 21-23 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Concerns have been raised in the literature on the suitability of time-independent methodologies (e.g., fault trees) for the reliability modeling of closed-loop control systems (CLCS), such as those used in nuclear power plants to maintain reactor vessel pressure and water level within allowed ranges. This paper (a) describes a methodology that utilizes CLCS simulator data for accurate dynamic reliability model construction and (b) illustrates the implementation of the methodology for the interval reliability analysis of high-pressure core spray system cooling of a boiling water reactor core following a small loss-of-coolant accident. The methodology is based on the modification of a dynamic modeling approach proposed earlier.

463 **Introduction to digital instrumentation and control techniques used in nuclear engineering.** Kurilla, R.G.; Kenney, E.S. *Transactions of the American Nuclear Society (USA),* 57: 25-27 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

For the past 8 yr, the nuclear engineering department at Pennsylvania State University has been teaching a digital interfacing class at the undergraduate (senior) level. With the ever-increasing use of computers in the nuclear engineering area (such as in the use of automated data acquisition systems) and the complexity of control instrumentation, more than a cursory introduction into electronics and computer controls is needed. Because of the ever-increasing popularity, and hence importance, of IBM-PC compatible microcomputers in the engineering fields, the program has been adapted to the Intel 8086 microprocessor. Courses such as this one are helpful in ensuring the students have an adequate design and practice base as required by accrediting groups. The course, is composed of three parts: (1) machine code/assembly language, (2) interfacing, and (3) final project. Experience demonstrates that a course of this inherent complexity can successfully be taught within a nuclear engineering curriculum without extensive prerequisites. The important ingredient is to treat nuclear engineering students for exactly what they are, engineers. By having them use their creativity and adaptability, they can successfully integrate the digital interfacing techniques now routinely used in the nuclear industry.

464 **Development and experimental demonstration of a noise-reduction technique for a nonlinear dynamic system.** Washio, T.; Bernard, J.A. *Transactions of the American Nuclear Society (USA),* 57: 96-97 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This summary describes a noise-reduction technique that functions within the framework of a Kalman filter and yet is applicable to nonlinear systems. This is accomplished by converting the exact nonlinear system model for use in the dynamic linear model of the Kalman filter. The effectiveness of this methodology has been demonstrated on the 5-MW(thermal) Massachusetts Institute of Technology (MIT) research reactor for the closed-loop control of reactor power. Modern digital noise-reduction techniques can be categorized depending on whether or not they are model-based. Major filtering techniques that do not use a model include finite impulse response, infinite impulse response, and e-nonlinear filtering. The significance of the present work is that a general-purpose noise-reduction technique suitable for rapid, nonlinear transients has been developed.

465 **A rigorous pole representation of multilevel cross sections and its practical applications.** Hwang, R.N. (Argonne National Lab., IL (USA). Applied Physics Div.). *Nuclear Science and Engineering (USA),* 96(3): 192-209 (Jul 1987).

In this article a rigorous method for representing the multilevel cross sections and its practical applications are described. It is a generalization of the rationale suggested by de Saussure and Perez for the s-wave resonances. A computer code WHOPPER has been developed to convert the Reich-Moore parameters into the pole and residue parameters in momentum space. Sample calculations have been carried out to illustrate that the proposed method preserves the rigor of the Reich-Moore cross sections exactly. An analytical method has been developed to evaluate the pertinent Doppler-broadened line shape functions. A discussion is presented on how to minimize the number of pole parameters so that the existing reactor codes can be best utilized.

466 **The centralized reliability data organization (CREDO) assessment of critical component unavailability in liquid-metal**

reactors. Koger, K.H. (Oak Ridge National Lab., TN (USA). Engineering Physics and Mathematics Div.); Haire, M.J.; Humphrys, B.L.; Manneschmidt, J.F.; Setoguchi, K.; Nakai, R. *Nuclear Technology (USA),* 85(3): 251-258 (Jun 1989).

In this article availability information contained within the Centralized Reliability Data Organization (CREDO) liquid-metal reactor (LMR) data base is presented, and the availability critical items lists are developed. Individual components are ranked in prioritized lists from worst to best performers from an availability standpoint. Availability, as used here, is assumed to be an inherent characteristic of the component and is not necessarily assumed to be related to plant operability.

467 **An expert system for PWR core operation management.** Ida, Toshio; Masuda, Masahiro; Nishioka, Hiromasa. *Transactions of the American Nuclear Society (USA),* 57: 238-240 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Planning for restartup after planned or unplanned reactor shutdown and load-follow operations is an important task in the core operation management of pressurized water reactors (PWRs). These planning problems have been solved by planning experts using their expertise and the computational prediction of core behavior. Therefore, the quality of the plan and the time consumed in the planning depend heavily on the skillfulness of the planning experts. A knowledge engineering approach has been recently considered as a promising means to solve such complicated planning problems. Many knowledge-based systems have been developed so far, and some of them have already been applied because of their effectiveness. The expert system REPLEX has been developed to aid core management engineers in making a successful plan for the restartup or the load-follow operation of PWRs within a shorter time. It can maintain planning tasks at a high-quality level independent of the skillfulness of core management engineers and enhance the efficiency of management. REPLEX has an explanation function that helps user understanding of plans. It could be a useful took, therefore, for the training of core management engineers.

468 **A knowledge-based system for control of xenon-induced spatial power oscillations during load-follow operations.** Chung, Sun-Kyo; Danofsky, R.A.; Spinrad, B.I. *Transactions of the American Nuclear Society (USA),* 57: 238 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

As is well known, large pressurized water reactors (PWRs) are subject to xenon-induced axial power oscillations at some time during a given cycle. Attention to this behavior is required during load-follow operations. A knowledge-based system for controlling xenon-induced spatial power oscillations is described. Experience with a limited set of load-follow patterns has demonstrated that the system is capable of providing advice on appropriate control actions. A simulation model, coupled with a rule-learning process, has been found to be a useful way for determining appropriate weights for the rules that relate power patterns and control actions.

469 **An examination of expert systems activities within the nuclear industry.** Bernard, J.A.; Washio, Takashi. *Transactions of the American Nuclear Society (USA),* 57: 240-241 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper provides an overview of a detailed evaluation that the authors recently completed on expert systems applications within the nuclear industry. That evaluation examined the motivation for utilizing expert systems, identified the areas to which they were being applied, and provided an assessment of their utility. Listed here are some of the salient findings of that report. (1) Utilities are developing their own artificial intelligence tools rather than using commercial products. (2) Few expert systems are being developed for the express purpose of capturing human expertise. (3) A number of successful expert systems have been developed to assist in plant design, management, and maintenance scheduling. (4) Interactive diagnostic systems are being developed for the analysis of physical processes that vary slowly. (5) Real-time diagnostic expert systems are currently at the cutting edge of the technology. (6) Operator adviser and emergency response expert systems constitute ~25% of the total. (7) Research on the use of expert systems for reactor control is quite active. (8) Too few quantitative evaluations of the benefits of expert systems to reactor operators have been performed. The operator's need is for timely, factual information on plant status. Hence, the true challenge to expert systems is real-time diagnostics.

470 **CAMAC control of diverse data acquisition instrumentation.** Montelongo, S. (Lawrence Livermore National Lab., CA (USA)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1665-1670 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The LLNL Nuclear Chemistry Counting Facility has been converted into a modern research facility. A distributed data-acquisition network has been designed and implemented for this conversion. A major task of the conversion was to provide support for diverse nuclear instrumentation using the CAMAC instrumentation standard. This paper addresses the design and implementation of a CAMAC subsystem incorporated into the data-acquisition network.

2205 Environmental Aspects

Refer also to citation(s) 494, 1437

471 (EPRI-NP–6551) **Fuel consolidation demonstration: Spent-fuel storage area analysis.** Electric Power Research Inst., Palo Alto, CA (USA); Northeast Utilities Service Co., Berlin, CT (USA); Combustion Engineering, Inc., Windsor, CT (USA). c Sep 1989. 151p. Sponsored by Electric Power Research Institute. DOE Contract AC06-76RL01830. (PNL–6963). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI, Northeast Utilities, Baltimore Gas and Electric, the Department of Energy, and Combustion Engineering are engaged in a program to develop a spent fuel consolidation storage system. Fuel consolidation offers a means of substantially increasing the capacity of spent fuel storage pools. Consolidation system equipment design, development, construction, and testing are being preformed by Combustion Engineering in Windsor, Connecticut. Seismic and structural evaluation of the capability of the Millstone Unit 2 spent fuel pool and building to accommodate the increased fuel capacity is being conducted by Northeast Utilities. NU plans to obtain a license to store consolidated fuel in the Millstone Unit 2 spent fuel pool. NU also plans to perform a hot demonstration of the integrated consolidation system with spent fuel at Millstone Unit 2. This report describes an evaluation of consolidating fuel at Millstone Unit 2 with regard to the exposure of station personnel and the genera; public, and also with regard to the additional cooling required because of the increase in spent fuel storage capacity. The evaluation showed that consolidation will not pose a health risk either to the operators or to the general public. The existing plant spent fuel cooling system was found to be adequate except in regard to limiting the bulk pool water temperature under certain circumstances during refueling when the pool was approaching being filled to the maximum with consolidated spent fuel. The report describes the administrative controls for dealing with this problem; the incidence of higher than recommended temperatures is expected to be very low. 8 refs., 38 figs., 15 tabs.

472 (INIS-mf–11153) **Nuclear power. CAEC lecturers' manual.** Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1987. 68p. (In Czech). Order Number DE88780081. Available from NTIS (US Sales Only), PC A04/MF A01.

Separate abstracts were prepared for the individual papers in this report. (JDB)

473 (SAND–89-1909C) **Discrete ordinates methods for radiation transport.** Badruzzaman, A.; Fan, W.C. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. (CONF-891103–15: Winter meeting of the American Nuclear Society, San Francisco,

CA (USA), 26-30 Nov 1989). Order Number DE89015794. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The discrete ordinates (S_N) method, first developed for stellar atmospheres, has been used extensively on various other radiation transport problems. In reactor analysis the method is generally used to generate parameters for design models based on more approximate but less expensive methods (such as diffusion theory) so that the spatial-spectrum coupling is represented accurately on a microscopic reaction rate level. It has a decisive advantage over Monte Carlo methods in computing the pin and assembly power profiles. In shielding problems where the penetration of the radiation can be deep, the method is used widely in design calculations. In oil-well logging problems which also involve deep penetration and have a stringent accuracy requirement on the detector responses, the method complements the Monte Carlo techniques. Recently, the discrete ordinates method with appropriate cross sections has been used in coupled photon-electron transport problems. In this paper the basic method is briefly reviewed, its applications illustrated, its merits and pitfalls discussed, and the recent advances in the attendant numerical techniques which have enhanced the capabilities of the method are enumerated. 28 refs., 1 fig.

474 **Integrating radwaste treatment equipment into radwaste processing systems.** Terrell, M.S. *Transactions of the American Nuclear Society (USA)*, 56: 85 (1988). (CONF-880601–: American Nuclear Society annual meeting, San Diego, CA (USA), 12-16 Jun 1988).

Low-level radioactive waste treatment equipment is gradually coming of age. This new generation of treatment equipment is becoming more and more sophisticated through the use of programmable controllers and computers. This paper focuses on how Duke Power company is attempting to integrate the various radwaste treatment equipment and systems at Oconee nuclear station into processing systems that will enable the operators to process radioactive waste efficiently and economically. Both long-range plans and current activities are discussed. The system that envisioned is a fully integrated, semiautomated radioactive waste processing system. The goal is no longer an unreasonable one, even in the utility industry. Personal computers, programmable controllers, and software packages make the integration of radwaste treatment equipment into processing systems a reasonable and achievable goal.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 386, 387, 388, 392, 425, 459, 460, 464, 483, 484, 499, 545, 932

475 (CONF-8909141–2) **Conversion and standardization of US university reactor fuels using LEU, status 1989.** Brown, K.R.; Matos, J.E. Argonne National Lab., IL (USA). [1989]. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number DE90001440. Available from NTIS, PC A03/MF A01; OSTI; INIS.

In 1986, the US Department of Energy initiated a program to change the fuel used in most of the US university research reactors using HEU (93%) to LEU(<20%) in order to minimize the risk of theft or diversion of this weapons-useable material. An important consideration in the LEU conversion planning process has been the desire to standardize the fuels that are used and to enhance the performance and utilization of the reactors. This paper describes the current status of this conversion process and the plans and schedules to complete an orderly transition from HEU to LEU fuel in most of these reactors. To date, three university reactors have been converted to LEU fuel, completed safety documentation for three reactors is being evaluated by the USNRC, and work on the safety documentation for six reactors is in progress. 13 refs., 9 tabs.

476 (INIS-BR–1673) **Components of neutronic state for calculating the phase library in the neutronic simulation of a low power experimental fast reactor.** Jachic, J. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores. [1989]. 1p. (In Portuguese). Order Number DE90606777. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

477 (ORNL/TM–11309) **Oak Ridge Research Reactor shutdown maintenance and surveillance quarterly report, April, May, and June 1989.** Hamrick, T.P.; Coleman, G.H.; Laughlin, D.L. Oak Ridge National Lab., TN (USA). Sep 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90000992. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the quarterly report for second quarter of CY 1989. Information is given on the fuel status, shutdowns, maintenance, changes in instrumentation and controls, usage of experimental facilities, a summary of surveillance tests, and status of filters and gaseous-waste systems. 9 tabs. (FSD)

478 (WHC-SA–0730) **Operating team training: Technical training's role.** Greene, G.L. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-8910239–1: 13. annual TRADE conference, Baltimore, MD (USA), 22-25 Oct 1989). Order Number DE90001237. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Technical trainers must assume an increased role in the team training of operating crews of a nuclear facility. Historically,team training has been a human resources type mission because of the focus on interpersonal skills and group skills. The technical trainers have traditionally confined themselves to job-specific technical areas. The gap between these two can be closed by the combined efforts to the two organizations, with the technical trainers taking the lead in program development. This paper describes key elements of the program developed by the training staff at the Fast Flux Test Facility, operated by Westinghouse Hanford Company for the US Department of Energy. 1 ref., 1 tab.

479 **GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor.** Levine, S.H.; Flinchbaugh, T.L.; Penkala, J.L.; Hughes, D.E.; Rudy, K.E.; Faust, C.; Maag, R. *Transactions of the American Nuclear Society (USA)*, 57: 16 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A requalification program was established for the Three Mile Island Unit 2 (TMI-2) reactor operators after the March 1979 accident made the TMI-2 reactor inoperable. A series of subcritical/critical experiments were designed using the Penn State Breazeale Research Reactor (PSBR) to establish this program. In general, several different subcritical experiments were performed to simulate attaining critical mass configurations that could have the potential to occur during the removal of the core of the damaged TMI-2 reactor. The requalification program was conducted every year beginning in 1981 and terminating in 1987. The experiments can be dichotomized into two separate sets of experiments. The first set of experiments consisted of the following five: (1) fuel collapse simulation, (2) defueling simulation, (3) deborating TMI-2 simulation, (4) simulation of fuel loading into submerged canisters, and (5) draining of reactor vessel simulation. Two experiments were performed in the second set of experiments: (1) Simulate displacing fuel with unborated and simulated borated water, and (2) Simulate replacing a spherical region of borated water with nonborated water.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 505, 506, 507, 528

480 (WSRC-RP–89-385) **Use of the linear variate method of Monte Carlo for estimating uncertainty in thermal-hydraulic codes.** Kubic, W.L. Jr.; White, A.M. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891103–28: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89017871. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thermal-hydraulic computer codes represent non-linear functions that may contain discontinuities. Monte Carlo methods are an effective means of accurately evaluating the effect of uncertainty on a nonlinear function with discontinuities, but the computational requirements of standard Monte Carlo methods may be prohibitive. The linear variate Monte Carlo method is a means of reducing the computational requirements. The linear variate method combines the linear response surface method with Monte Carlo analysis to obtain an efficient and accurate method of nonlinear uncertainty analysis. The method is applied to the power limit analysis for the Savannah River Site reactors. 7 refs., 2 figs., 3 tabs.

2209 Reactor Safety

Refer also to citation(s) 147, 163, 173, 203, 335, 339, 340, 356, 384, 385, 393, 423, 452, 457, 462, 471, 475, 477, 967, 1437, 1838

481 (BMU–1989-214) **Experimental investigations of the sensitivity of hydrogen-steam-air mixtures with regard to the deflagration-detonation transition.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Behrens, U.; Langer, G.; Stock, M.; Wirkner-Bott, I. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.). Dec 1988. 205p. (In German). Contract BMU SR 394. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The experiments were aimed at investigating the deflagration-detonation transition (DDT) in H_2-steam-air mixtures. In a first of experimental series temperatures around 100^{0}C and pressures between 1 and 2 bar were used so that the results easily could be compared with those of other institutions (Battelle). A second series focused on the behaviour of mixtures under thermodynamic conditions as anticipated in the containment in the event of a core melt accident (2-3 bar, 120-130^{0}C, relatively high steam fraction). The investigations have yielded further information about the transition from deflagration to detonation, which may take place in the containment of LWRs in the event of a core melt accident. They will thus contribute to the determination of the residual risk. (orig./DG).

482 (CONF-880913–9) **What was learned in developing the 1987 Zion Federal Field Exercise that can be used in planning other emergency response exercises?.** Weiss, B.H.; Adler, M.V.; Gant, K.S. Oak Ridge National Lab., TN (USA). [1988]. 6p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. From ANS topical meeting on emergency response: planning, technologies and implementation; Charleston, SC (USA); 26-28 Sep 1988. Order Number DE90001609. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The second Federal Field Exercise (FFE-2) was held in conjunction with the 1988 full participation exercise at the Zion nuclear power plant. This three-day exercise focused on the evaluation of the Federal Response plan and the numerous interfaces of the Federal agencies with the offsite authorities and the utility. Because of the many unique aspects of this exercise and the large number of participants, the planning effort for this exercise was considerably more involved than routine exercises. This paper provides a discussion of the process of developing such an exercise (i.e., the decisions, organization, resources, documents, and staffing that were necessary) plus the lessons learned from the FFE-2 that might be applied to other emergency response exercises.

483 (CONF-891027–3) **Large break loss-of-coolant accident analyses for the high flux isotope reactor.** Taleyarkhan, R.P. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International symposium on research reactor safety, operations and modifications; Chalk River (Canada); 23-27 Oct 1989. Order Number DE90001361. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The US Department of Energy's High Flux Isotope Reactor (HFIR) was analyzed to evaluate it's response to a spectrum of loss-of-coolant accidents (LOCAs) with potential for leading to core damage. The MELCOR severe accident analysis code (version 1.7.1) was used to evaluate the overall dynamic response of HFIR. Before conducting LOCA analyses, the steady-state thermal-hydraulic parameters evaluated by MELCOR for various loop sections were verified against steady-state operating data. Thereafter, HFIR depressurization tests were simulated to evaluate the system pressure change for a given depletion in coolant inventory. Interesting and important safety-related phenomena were observed. The current analyses (which should be considered preliminary) that occur over a period from 1 to 3 seconds do not lead to core wide fuel melting. Core fluid flashing during the initial rapid depressurization does cause fuel temperature excursions due to adiabatic-like heatup. 3 refs., 4 figs.

484 (CONF-891027–4) **Risk and safety analysis in support of the operation at the High Flux Isotope Reactor at Oak Ridge.** Flanagan, G.F.; Cook, D.H.; Johnson, D.H.; Buttemer, D.; Perla, H.F.; Chien, S.H.; Kaplan, S.; Craddick, W.G. Oak Ridge National Lab., TN (USA). [1989]. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International symposium on research reactor safety, operations and modifications; Chalk River (Canada); 23-27 Oct 1989. Order Number DE90001345. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The High Flux Isotope Reactor (HFIR) is a high performance isotope production and research reactor which has been in operation at Oak Ridge National Laboratory (ORNL) since 1965. In late 1986 the reactor was shut down as a result of discovery of unexpected neutron embrittlement of the reactor vessel. In January of 1988 a Level 1 Probabilistic Risk Assessment (PRA) (excluding external events) was published as part of the response to the many reviews that followed the shutdown and for use by ORNL to prioritize action items intended to upgrade the safety of the reactor. A conservative estimate of the core damage frequency initiated by internal events for HFIR was 3.11×10^{-4}. It was dominated by flow blockages and loss of all AC power. In June 1989 a draft external events initiated PRA was published. The dominant contributions from external events came from seismic, wind, and fires. The overall external event contribution to core damage frequency is about 50 percent of the internal event initiated contribution and is dominated by seismic events. Several design and safety analysis studies were undertaken to support the restart of the HFIR. The first study involved a fracture mechanics analysis and redesign of the reactor operating conditions and safety system setting to provide a basis for future operation. Another study involved performing a risk analysis by combining the Level 1 PRA results with offsite consequence analyses under conservative assumptions about the fission product removal within the plant. Additional studies were performed to establish a long-term decay heat removal design basis. Finally, updated and upgraded loss-of-cooling accident studies were performed and are still underway. 5 refs., 11 figs., 6 tabs.

485 (CONF-891140–1) **Loss-of-coolant accident experiment at the AVR gas-cooled reactor.** Cleveland, J.; Krueger, K. Oak Ridge National Lab., TN (USA). [1989]. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Session on thermal-hydraulic aspects of passive safety; San Francisco, CA (USA); 27-30 Nov 1989. Order Number DE89013579. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Loss-of-coolant is one of the most severe accidents for a nuclear power plant. To demonstrate inherent safety characteristics incorporated into small High-Temperature Gas Cooled Reactor (HTGR) designs, loss-of-coolant accident (LOCA) simulation tests have been conducted with the German pebble-bed High-Temperature Reactor AVR. The AVR is the only nuclear power plant ever to have been intentionally subjected to LOCA conditions. The LOCA test was planned to create conditions that would exist if a rapid LOCA occurred with the reactor operating at full power. The tests demonstrated this reactor's safe response to an accident in which the coolant escapes from the reactor core and no emergency system is available to provide coolant flow to the core. The test is of special interest because it demonstrates the inherent safety features incorporated into modular HTGR designs. The main LOCA test lasted for 5 d. After the test began, core temperatures increased for ~13 h and then gradually and continually decreased as the rate of heat dissipation from the core exceeded accident levels of decay power.

Throughout the test, temperatures remained below limiting values for the core and other reactor components. 3 refs., 9 figs., 1 tab.

486 (DOE/FTR–90001725) **[Development of risk-based safety indicators]: Foreign trip report, July 1, 1989–July 9, 1989.** Boccio, J.L. Brookhaven National Lab., Upton, NY (USA). 21 Sep 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001725. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The intent of the report was to describe the state of knowledge in the development of risk-based performance indicators. In performing its assigned tasks, the consultancy largely relied on research being conducted by the IAEA, Institute of Nuclear Power Operations (INPO) and the US Nuclear Regulatory Commission (NRC). This work was presented and discussed by Bojan Tomic during the IAEA-sponsored Technical Committee Meeting on the Use of Numerical Indicators to Enhance Nuclear Plant Performance (Vienna, September 4–8, 1989).

487 (DOE/SSDP–0092) **Completion of the Shippingport reactor decommissioning.** Schreiber, J.J. Westinghouse Hanford Co., Shippingport, PA (USA). Shippingport Station Decommissioning Project Office. [1989]. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-84RL10421;AC06-87RL10930. (CONF-891077–1: International conference on decommissioning of nuclear installations, Brussels (Belgium), 24-27 Oct 1989). Order Number DE90001658. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Planning for the decommissioning of the Shippingport Atomic Power Plant began in 1979 and ended with publication of the Decommissioning Plan in 1983. The site was available for occupation by the Decommissioning Operations Contractor in September 1984 and physical work on decommissioning commenced in September 1985. This physical work was completed 3.75 years later, almost 6 months ahead of schedule. The total cost will be $92M which is $6M less than the $98M estimated. A breakdown of planned and actual statistics is presented for various aspects of the decommissioning work including: Cost, schedule, manpower, radiation exposures, waste arisings and shipments. Various aspects concerning contracts, decontamination, asbestos, safety, lessons learned and technology transfer are also presented. 19 figs., 6 tabs.

488 (DPT–128) **Major issues on establishing an emergency plan in nuclear facilities.** Chen, Zhu-zhou. 21p. Translated from Fushe Fanghu (China). *Fushe Fanghu (China),* 8(2): 81-88 (Mar 1988). Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035.

Several major issues on emergency planning and preparation in nuclear facilities were discussed – such as the importance of emergency planning and preparation, basic principles of intervention and implementation of emergency plan and emergency training and drills to insure the effectiveness of the emergency plan. It is emphasized that the major key point of emergency planning and response is to avoid the occurrence of serious nonrandom effect. 12 refs., 3 tabs.

489 (EGG-M–89187) **Study of hydrogen mixing within the Combustion Engineering System 80+ containment.** Hawley, J.T.; Hammersley, R.J.; Plys, M.G. EG and G Idaho, Inc., Idaho Falls, ID (USA); Fauske and Associates, Inc., Burr Ridge, IL (USA). May 1989. 45p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891103–23: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89016195. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A scoping study has been performed to determine how hydrogen would be distributed throughout an evolutionary, advanced Pressurized Water Reactor (PWR) spherical containment given a variety of hydrogen delivery rates to the containment and a variety of delivery locations. The study used the Electric Power Research Institute's Modular Accident Analysis Program (MAAP) and a preliminary containment design model for the Combustion Engineering (C-E) System 80+ Standard Design as the basis of the detailed thermal-hydraulic analyses of the containment performance. The archived version of MAAP required modification to input/output subroutines and its initialization subroutine to account for a unique feature of this containment design, the in-containment refueling water storage tank (IRWST). This paper describes the method and the results of the detailed calculations. It also compares the results obtained to the applicable design criteria from the ALWR Requirements Document published by the Electric Power Research Institute (EPRI). These comparisons show the design criteria are satisfied when hydrogen from the primary system is delivered to the containment outside the IRWST. Some hydrogen delivery rates into the IRWST, however, result in large enough hydrogen concentrations in the IRWST gas space that the possibility of localized detonations cannot be definitively ruled out. These short-lived, large hydrogen concentrations occur in the IRWST gas space even if the presence of an ignition source is assumed due to oxygen depletion and the limited capability of the conceptual design configuration analyzed to resupply oxygen to the IRWST. These latter cases suggest that further analysis of the detonation characteristics of the IRWST gas space is required or that changes to the IRWST design may be warranted. 7 refs., 20 figs., 4 tabs.

490 (EGG-M–89256) **Criticality safety margins provided by moderator control in the TMI-2 dry storage cask.** Briggs, J.B.; Jones, R.R.; Martin, M.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891118–5: International meeting on nuclear criticality safety margins, San Francisco, CA (USA), 26 Nov - 1 dec 1989). Order Number DE89016205. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A dry storage cask has been designed to provide storage for TMI-2 defueling canisters at the Idaho National Engineering Laboratory. Criticality safety margins will be provided by moderator controls imposed on the canisters (prior to insertion into the cask) and on the cask (during a 50-yr storage time). Criticality safety calculations demonstrate that an adequate margin of safety exists for the proposed storage of defueling canisters in the TMI-2 dry storage cask. 9 refs., 5 figs., 3 tabs.

491 (INIS-mf–12021) **Survey of incidents in West German nuclear power plants in the second quarter of the year 1989.** Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.). 1989. 10p. (In German). Order Number DE90718251. Available from NTIS (US Sales Only), PC A02/MF A01.

78 incidents were reported. Three incidents fall into category E (immediate notification). 75 incidents belong to the lowest category N (normal notification) and to the category V (pre-commissioning phase). There were no incidents of category S (direct notification). (orig./HP).

492 (KFK–4593) **Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR.** Mori, T.; Cigarini, M.; Dalle Donne, M. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit (PRS). Jul 1989. 24p. Order Number DE90718098. Available from NTIS (US Sales Only), PC A03/MF A01.

After the reflooding tests in an extremely tight bundle (p/d=1.06, FLORESTAN 1) have been completed, new experiments for a wider lattice (p/d=1.242, FLORESTAN 2), which is employed in the recent APWR design of KfK, are planned at KfK to obtain the benchmark data for validation and improvement of calculation methods. This report presents the results of pre-test calculations for the FLORESTAN 2 experiment using FLUT-FDWR, a modified version of the GRS computer code FLUT for analysis of the most important behaviour during the reflooding phase after a LOCA in the APWR design. (orig.).

493 (NUREG/CP–0102-Vol.2) **NRC regulatory information conference: Proceedings.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Sep 1989. 479p. Sponsored by Nuclear Regulatory Commission. (CONF-8904274–Vol.2: NRC regulatory information conference, Washington, DC (USA), 18-20 Apr 1989). Available from NTIS, PC A21/MF A01 - GPO; OSTI; INIS.

With the shift of the Nuclear Regulatory Commission's (NRC's) focus from construction to operations, culminating in 1987, the NRC

staff's inspections and review and analysis of information have resulted in initiatives in many areas, including the Severe Accident Program, requalification, emergency operating procedures, maintenance, design reconstitution, and other areas related to operational safety. The purpose of this conference was to provide a unique forum for nonconfrontational communications between NRC management and senior managers in the nuclear industry. Also, the conference was to provide a stage for NRC to articulate any concerns related to industry's implementation of safety initiatives and to clarify any industry concerns about NRC regulatory actions. The NRC's intent with regard to this conference was to facilitate a better understanding by the licensed community of the basis for NRC's regulatory initiatives. The NRC provided information in implemented initiatives and their bases and discussed its expectations for new initiatives in hopes that this type of exchange would foster a better understanding between the industry and the NRC regarding initiatives to achieve improved plant safety.

494 (NUREG/CP–0104) **Transactions of the seventeenth water reactor safety information meeting.** Weiss, A.J. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research. Oct 1989. 186p. Sponsored by Nuclear Regulatory Commission. (CONF-8910222–Summs.: 17. water reactor safety information meeting, Rockville, MD (USA), 23-25 Oct 1989). Available from NTIS, PC A09/MF A01 - GPO; OSTI; INIS.

This report contains summaries of papers on reactor safety research to be presented at the 17th Water Reactor Safety Information Meeting at the Holiday Inn Crowne Plaza in Rockville, Maryland, October 23–25, 1989. The summaries briefly describe the programs and results of nuclear safety research sponsored by the Office of Nuclear Regulatory Research, USNRC. Summaries of invited papers concerning nuclear safety issues from the electric utilities, the Electric Power Research Institute (EPRI), the nuclear industry, and from the governments and industry in Europe and Japan are also included. The summaries have been compiled in one report to provide a basis for meaningful discussion and information exchange during the course of the meeting, and are given in the order of their presentation in each session. The individual papers have been cataloged separately.

495 (NUREG/CR–1754-Add.1) **Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information.** Short, S.M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 221p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A10/MF A01 - GPO; OSTI; INIS.

Cost and safety information is developed for the conceptual decommissioning of non-fuel-cycle nuclear facilities that represent a significant decommissioning task in terms of decontamination and/or disposal activities. Reference facilities examined in this study include six types of laboratories and three site elements associated with materials facilities that require some decommissioning effort. Decommissioning of these reference facilities and sites can be accomplished using techniques and equipment that are in common industrial use. Since decommissioning technology for non-fuel-cycle nuclear facilities has not changed appreciably since publication of NUREG/CR-1754, essentially the same technology assumed in that study is used in this study. For the reference laboratory-type facilities, the study approach is to first evaluate decommissioning of representative components (e.g., hoods, glove boxes, building surfaces, exhaust system ductwork, etc.) that are common to many laboratory facilities. Reference laboratories are then analyzed using data for individual components (the unit-component approach) to provide information about the costs and safety of decommissioning entire facilities. DECON is the decommissioning alternative evaluated for the reference laboratories because it results in release of the facility for unrestricted use as soon as possible. For a facility, DECON requires that contaminated components either be: (1) decontaminated to unrestricted release levels or (2) packaged and shipped to an authorized disposal site. 41 refs., 27 figs.

496 (NUREG/CR–5098) **An analytical study of seismic threat to containment integrity.** Amin, M.; Agrawal, P.K.; Ahl, T.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Sargent and Lundy, Chicago, IL (USA); CBI Na-Con, Inc., Oak Brook, IL (USA). Jul 1989. 358p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–88-7018). Available from NTIS, PC A13/MF A01 - GPO; OSTI; INIS.

This report contains 2 microfiche supplements.

The methodology used and the results of an analytical scoping study of the seismic capacity of four containment buildings located in the Eastern United States are described in this report. The study was undertaken to provide quantitative information of containment seismic capacity considering a rather complete list of limit states. This type of information was not available previously. The four containments represent a cross-section of containment, reactor, and foundation types. Evaluations included time history analyses, four combinations of seismic with pressure and temperature loading to consider different severe accident conditions, and seismic aftershocks. Containments were evaluated for applicable limit states from a list of sixteen limit states that included structural, penetration, and foundation failures. The results are presented in terms of capacity margin factors at a prescribed value of peak horizontal ground acceleration, or by stating the seismic capacity in the governing limit states when the capacity is smaller than the acceleration value at which margin factors are listed. For certain critical limit states, curves showing the variation of capacity margin factor with peak horizontal ground acceleration are presented. The report also includes a discussion of factors that are significant for determining seismic and provides recommendations for future work. 25 refs., 285 figs., 70 tabs.

497 (NUREG/CR–5395-Vol.3) **Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 542p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.3;BAW–2061-Vol.3). Available from NTIS, PC A17/MF A01 - GPO; OSTI; INIS.

Includes 6 sheets of microfiche supplements.

The multiloop integral system test (MIST) is part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock and Wilcox-designed plants. MIST is sponsored by the US Nuclear Regulatory Commission, the Babcock and Wilcox Owners Group, the Electric Power Research Institute, and Babcock and Wilcox. The unique features of the Babcock and Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral system facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility — the once-through integral system (OTIS) — was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP-5 and TRAC, for predicting abnormal plant transients. The MIST program is reported in 11 volumes. The program is summarized in Volume 1; Volumes 2 through 8 describe groups of tests by test type; Volume 9 presents inter-group comparisons; Volume 10 provides comparisons between the calculations of RELAP5 MOD2 and MIST observations, and Volume 11 presents the later, Phase 4 tests. This is Volume 3 pertaining to Test Group 31, Boundary Conditions Variations. The specifications, conduct, observations, and results of these tests are described. 8 refs., 328 figs., 15 tabs.

498 (NUREG/CR–5395-Vol.5) **Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 242p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.5;BAW–2064). Available from NTIS, PC E10/MF E01 - GPO; OSTI; INIS.

Includes 3 sheets of microfiche supplements.

The multiloop integral system test (MIST) was part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock & Wilcox-designed plants. MIST was sponsored by the US Nuclear Regulatory Commission, the Babcock & Wilcox Owners Group, the Electric Power Research Institute and Babcock & Wilcox. The unique features of the Babcock & Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral system facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility – the once-through integral system (OTIS) – was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP-5 AND TRAC, for predicting abnormal plant transients. 5 refs., 136 figs., 13 tabs.

499 (ORNL/TM–11311) **Building Shielding Facility quarterly report, April, May, and June 1989.** Laughlin, D.L.; Hamrick, T.P. Oak Ridge National Lab., TN (USA). Sep 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001859. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Bulk Shielding Reactor (BSR) remained shut down during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The Pool Critical Assembly (PCA) is shut down for shim-safety rod magnets and associated electronic components upgrading. 1 fig., 10 tabs.

500 (PNL-SA–17354) **Development of international exemption principles for recycle and reuse.** Kennedy, W.E. Jr. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 10p. Sponsored by U.S. DOE Environment Health & Safety; International Energy Agency. DOE Contract AC06-76RL01830. (CONF-8909236–1: JAERI/EPA workshop on residual radiation and recycle criteria, St. Michaels, MD (USA), 27-28 Sep 1989). Order Number DE90001389. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The International Atomic Energy Agency (IAEA) has been investigating the possibility of exempting certain radiation sources and practices from regulatory control as an extension of its earlier work in the area of de minimis. Because of the potential value of scrap materials recovered during decommissioning of commercial reactors, and because of national and international efforts to minimize radioactive wastes, exemption criteria for recycle and reuse have gained attention. The IAEA has established basic principles for exemption that limit the radiation dose that individuals or population groups may receive from exempted practices or sources. This paper discusses the recent IAEA Advisory Group's recommendations on principles for radiation practices and sources in the recycling of retired components and materials from nuclear facilities. The background of the Advisory Group's work is discussed, then its methods and preliminary recommendations are summarized. Finally, a similar effort sponsored by the Commission of the European Communities is summarized and compared to the IAEA approach. 8 refs., 3 tabs.

501 (REG/G–90001148) **Standard format and content for decommissioning plans for nuclear reactors.** Feldman, C. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research. Sep 1989. 23p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A03/MF A01; OSTI; INIS.

General requirements for applications for license termination and decommissioning nuclear reactors are contained in 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities," in §50.82, "Applications for Termination of Licenses." On June 27, 1988 (53 FR 24018, to be effective July 27, 1988). The Commission published amendments to 10 CFR Part 50, along with other parts of its regulations, concerning specific criteria for decommissioning nuclear facilities. The revised §50.82 requires that an application for license termination be accompanied or preceded by a proposed decommissioning plan. This draft regulatory guide has been developed and issued for public comment in conjunction with publication of the decommissioning rule. The purpose of this guide is to identify the information needed and to present a format acceptable to the NRC staff for preparing and submitting a decommissioning plan. 7 refs.

502 (REG/G–90001149) **Records important for decommissioning of nuclear reactors.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research. Sep 1989. 10p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A02/MF A01; OSTI; INIS.

The general requirements for applications for license termination and decommissioning of nuclear reactors are contained in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." On June 27, 1988, the NRC amended its regulations in 10 CFR Part 50 concerning specific criteria for decommissioning nuclear facilities (53 FR 24018). Amended paragraph 50.75(g) requires licenses to keep records of information important to safe and effective decommissioning in an identified location until the license is terminated by the NRC. This section of the rule also identifies the kind of information the NRC considers important to decommissioning. This draft regulatory guide has been developed in conjunction with the decommissioning rule amendments and is being published for public comment. The purpose of this guide is to provide guidance concerning the specific information that should be kept and maintained in the decommissioning records required by the rule amendments regarding the radiological conditions at the plant that could affect occupational and public health and safety during decommissioning.

503 (SAND–89-2547C) **Accident progression analysis of past severe accidents.** McCloskey, D.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910255–1: International workshop on severe accidents and their consequences, Sochi City (USSR), 30 Oct - 1 nov 1989). Order Number DE90001624. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Accident progression analysis methods employed in NUREG-1150 are reviewed, with application to the Surry plant. It is proposed that these methods could be useful in the analysis of past severe accidents, such as occurred at Chernobyl. 2 refs., 8 figs.

504 (UCRL–101842) **Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities.** Dickerson, M.H.; Foster, K.T. Lawrence Livermore National Lab., CA (USA). Sep 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-891108–1: International symposium on recovery operations in the event of a nuclear power plant accident, Vienna (Austria), 6-10 Nov 1989). Order Number DE90001511. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

One of the most important uses of dose assessment models in response to accidents at nuclear facilities is to help provide guidance to emergency response managers for identifying, and mitigating, the consequences of an accident once the accident has been terminated. By combining results from assessment models with radiological measurements, a qualitative methodology can be developed to aid emergency response managers in determining the total dose received by the population and to minimize future doses through the use of mitigation procedures. To illustrate the methodology, this discussion focuses on the use of models to estimate the dose delivered to the public both during and after a nuclear accident. 4 refs., 10 figs., 1 tab.

505 (WHC-SA–0753) **N Reactor external events probabilistic risk assessment.** Baxter, J.T. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910192–14: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90001138. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An external events probabilistic risk assessment of the N Reactor has been completed. The methods used are those currently being proposed for external events analysis in NUREG-1150. Results are presented for the external hazards that survived preliminary screening. They are earthquake, fire, and external flood. Core damage frequencies for these hazards are shown to be comparable to those for commercial pressurized water reactors. Dominant fire sequences are described and related to 10 CFR 50, Appendix R design requirements. Potential remedial measures that reduce fire core damage risk are described including modifications to fire protection

systems, procedure changes, and addition of new administrative controls. Dominant seismic sequences are described. The effect of non-safety support system dependencies on seismic risk is presented. 7 refs., 2 figs., 1 tab.

506 (WSRC-RP–89-25) **Probabilistic evaluation of main coolant pipe break indirectly induced by earthquakes: Savannah River Project L and P Reactors.** Short, S.A.; Wesley, D.A.; Awadalla, N.G.; Kennedy, R.P. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8910192–11: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90001374. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A probabilistic evaluation of seismically-induced indirect pipe break for the Savannah River Project (SRP) L- and P-Reactor main coolant (process water) piping has been conducted. Seismically-induced indirect pipe break can result primarily from: (1) failure of the anchorage of one or more of the components to which the pipe is anchored; or (2) failure of the pipe due to collapse of the structure. The potential for both types of seismically-induced indirect failures was identified during a seismic walkdown of the main coolant piping. This work involved: (1) identifying components or structures whose failure could result in pipe failure; (2) developing seismic capacities or fragilities of these components; (3) combining component fragilities to develop plant damage state fragilities; and (4) convolving the plant seismic fragilities with a probabilistic seismic hazard estimate for the site in order to obtain estimates of seismic risk in terms of annual probability of seismic-induced indirect pipe break. 6 refs., 5 figs., 2 tabs.

507 (WSRC-RP–89-376) **Applications of probabilistic risk assessment to criticality safety at the Savannah River Site.** Lux, C.R.; Fisk, P.L. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891118–9: International meeting on nuclear criticality safety margins, San Francisco, CA (USA), 26 Nov - 1 dec 1989). Order Number DE89017847. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Since 1973 the Savannah River Laboratory (SRL) has used Probabilistic Risk Assessment to determine the frequency for criticality accidents at the Savannah River Site. The Savannah River Site is unique in that it has a detailed, site specific, data bank based on 35 years of facility operation. Use of this data bank with Probabilistic Risk Assessment precipitated facility actions which resulted in the reduction of the calculated criticality frequency by as much as two orders of magnitude. Probabilistic Risk Assessment has also been used to quantify the impact of non-process-related systems on criticality safety.

508 **Development of an accident management expert system for containment assessment.** Nelson, W.R. (Idaho National Engineering Lab., EG and G Idaho Inc., Idaho Falls, ID (US)); Sebo, D.E.; Haney, L.N. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

The United States Nuclear Regulatory Commission (USNRSC) is sponsoring a program at the Idaho National Engineering Laboratory (INEL) to develop an accident management expert system. The intended users of the system are the personnel of the NRC Operations Center in Washington, D.C. The expert system will be used to help NRC personnel monitor and evaluate the status and management of the containment during a severe reactor accident. The knowledge base will include severe accident knowledge regarding the maintenance of the critical safety functions, especially containment integrity, during an accident. This paper summarizes the concepts that have been developed for the accident management expert system, and the plans that have been developed for its implementation.

509 **An expert system design incorporating fuzzy logic for diagnosing heat imbalances in a nuclear power plant.** Guth, M.A.S. (Dept. of Economics, The Univ. of Tennessee, Knoxville, TN (US)). pp. 288 of Proceedings of the third annual expert systems in government conference. Antonisse, H.J.; Benoit, J.W.; Silverman, B.G IEEE Service Center, Piscataway, NJ (1987). (CONF-8710106–: 3. annual expert systems in government conference, Washington, DC (USA), 19-23 Oct 1987).

This paper presents an expert system for diagnosing problems in the interface between the heat exchanger and the core of a nuclear power plant for a hypothetical pressurized water reactor (PWR). The expert system has a production rule backward-chaining-based architecture, and the knowledge base incorporates four kinds of information. First, the structural relationship between causes and consequences is given by nuclear engineering experts. Second, numerical values for the initiating events can be taken from observed performance of the reactor under normal conditions. Third, the causes of particular events are ranked in order of their likelihood based on a combination of a priori knowledge about the reactor design and actual data on the incidence of component failures. Fourth, Bellman-Zadeh Fuzzy Logic is introduced to maintain truth values for expert system rules that hold with varying degrees of certainty.

510 **Hydrogen generation during fuel/coolant interactions.** Young, M.F. (Sandia National Labs., Albuquerque, NM (USA)); Berman, M.; Pong, L.T. *Nuclear Science and Engineering (USA)*, 98(1): 1-15 (Jan 1989).

During a severe nuclear plant accident, molten fuel can contact water in the core region, the lower plenum, or in the cavity below the reactor vessel. The interactions that take place can vary from benign boiling to explosive vaporization. If the fuel contains a metallic component, rapid oxidation of the metal can occur during the fuel/coolant interaction (FCI). The hydrogen generated from this reaction can increase the threat to containment integrity. Experiments have been conducted with 10 to 20 kg of two kinds of thermite-generated molten fuel stimulants: corium and iron-aluminum oxide. The experiments are described in this paper and predictions are made based on experimental observations.

511 **Identification of the operating crew's information needs for accident management.** Nelson, W.R.; Hanson, D.J.; Ward, L.W.; Solberg, D.E. *Transactions of the American Nuclear Society (USA)*, 57: 71-72 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

While it would be very difficult to predetermine all of the actions required to mitigate the consequences of every potential severe accident for a nuclear power plant, development of additional guidance and training could improve the likelihood that the operating crew would implement effective sever-accident management measures. The US Nuclear Regulatory Commission (NRC) is conducting an Accident Management Research Program that emphasizes the application of severe-accident research results to enhance the capability of the plant operating crew to effectively manage severe accidents. One element of this program includes identification of the information needed by the operating crew in severe-accident situations. This paper discusses a method developed for identifying these information needs and its application. The methodology has been applied to a generic reactor design representing a PWR with a large dry containment. The information needs were identified by systematically determining what information is needed to assess the health of the critical functions, identify the presence of challenges, select strategies, and assess the effectiveness of these strategies. This method allows the systematic identification of information needs for a broad range of severe-accident scenarios and can be validated by exercising the functional models for any specific event sequence.

512 **A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme.** Salim, P. (Texas A & M Univ., College Station (USA)); Hassan, Y.A. *Transactions of the American Nuclear Society (USA)*, 57: 143 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The complex nature of nuclear power plants makes it essential to have an extensive understanding of its behavior under various operation conditions. One of the analysis methods is to perform simulations on quantifies system computer codes. These codes provide the analyst with a tool to predict the system behavior under

normal and abnormal conditions. Prior information obtained from such analyses becomes of paramount importance in designing and operating a nuclear power system. The purpose of this study is to develop a RELAP5/MOD2 model of a nuclear power plant and conduct a sensitivity study on the nodalization scheme. The RELAP5/MOD2 predictions are compared with the RETRAN2/MOD3 results and favorable agreement is obtained.

513 **Analysis of loss-of-feedwater transients in MB-2 using RELAP5/MOD2.** Kalyanasundaram, M. (Texas A & M Univ., College Station (USA)); Hassan Y.A. *Transactions of the American Nuclear Society (USA),* 57: 143-147 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The steam generator is the major controlling component in a wide range of transients and accidents in pressurized water reactors. The need to understand the steam generator response to transient conditions has led to many experimental and analytical investigations. In this study a RELAP5/MOD2 model was developed for the Westinghouse model F steam generator test facility model boiler No. 2 (MB-2). Model boiler No. 2 is an ≈0.8% power scaled representation of the model F steam generator unit. The objective of the MB-2 test program was to provide comprehensive data on the thermal-hydraulic behavior of the steam generator under transient conditions. The objective of this study is to simulate the test facility using Texas A & M's RELAP5/MOD2. The code's steady-state and loss-of-feedwater transient predictions were compared with the test data. A favorable agreements was obtained. Further refinement in the heat transfer correlations in the tube bundle is needed.

514 **Reactivity transients during a blowdown in a MSIV closure ATWS.** Cheng, H.S. (Brookhaven National Lab., Upton, NY (USA)); Diamond, D.J. *Transactions of the American Nuclear Society (USA),* 57: 147-148 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Anticipated transients without scram (ATWS) events have received considerable attention in the past and are still a subject of great interest in severe-accident analysis. Of special interest is the effect of the low-pressure emergency core cooling system (ECCS) on the plant response following a blowdown by the automatic depressurization system (ADS). There is a potential for positive reactivity insertion due to the cold water injection of the low-pressure coolant injection (LPCI) system and the low-pressure core spray system in a boiling water reactor (BWR)/4. The main concern is whether a power excursion and pressure oscillation can occur in such an event. Furthermore, since thermal-hydraulic feedback plays an important role in these accidents, the uncertainty of the reactivity feedback coefficients used can impact the outcome of the analysis for such a power excursion. The objectives of the work reported in this paper are to study the consequences of the reactivity transients during a blowdown in an ATWS event with closure of the main steam isolation valves (MSIVs) and to evaluate the effect of the LPCI system and the sensitivity of plant response to the feedback coefficients. This work was performed with the Brookhaven National Laboratory plant analyzer.

515 **ANSPipe: An IBM-PC interactive code for pipe-break assessment.** Fullwood, R.R. (Brookhaven National Lab., Upton, NY (USA)); Harrington, M. *Transactions of the American Nuclear Society (USA),* 57: 148-149 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The advanced neutron source (ANS) being designed at Oak Ridge National Laboratory will be the world's highest flux neutron source and best facility for associated basic and applied research. The ANSPipe code was written as an aid for the piping configuration and material selection to enhance safety and availability. The primary calculation is based on the Thomas mode. which models pipe leak or break probabilities as proportional to the length of the segment and diameter and the inverse square of the wall thickness. This scaling, based on experience, is adjusted for radiation effects, using the Regulatory Guide 1.99 model, and for cyclic fatigue, stress corrosion, and inspection, using adaptations form the PRAISE-B code. The key to an ANSPipe analysis is the definition of the pipe segments. A pipe segment is defined as a length of pipe in which all the parameters affecting the pipe are constant or reasonably so. Thus, a segment would be a length of pipe of constant diameter, thickness, material type, internal pressure, flux distribution, stress, and submergence or nonsubmergence.

516 **Analysis of postulated unscrammed loss of flow in SAFR using SSC.** Slovik, G.C. (Brookhaven National Lab., Upton, NY (USA)); Van Tuyle, G.J. *Transactions of the American Nuclear Society (USA),* 57: 149-151 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Brookhaven National Laboratory is providing technical assistance to the US Nuclear Regulatory Commission in reviewing two advanced liquid-metal reactor (LMR) designs in order to address the licensability of these innovative concepts. The designs, PRISM and SAFR are being proposed by General Electric Company and Rockwell International (RI), respectively. Brookhaven National Laboratory has utilized the super system code (SSC) to independently evaluate the LMR reactor system response during several postulated unscrammed events. This paper describes the SAFR reactor responses to a beyond-design base event where forced cooling is lost. A similar transient analysis has already been reported for PRISM.

517 **Comparison of the effect of insulating blockages on metal and oxide fuel elements.** Tilbrook, R.W.; Dever, D.J. *Transactions of the American Nuclear Society (USA),* 57: 151-153 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The safety philosophy of the new liquid-metal reactor (LMR) plant designs is oriented toward inherent protection against loss of coolable geometry and other entries to core disruption. One potential entry is via propagation of local faults. The basic event in all local sequences is cladding failure, irrespective of initiator. A model of a complete insulating blockage, i.e., total loss of heat transfer from the cladding surface due to any cause, was developed for a range of insulated arcs. The internal properties represented either metal or oxide fuels, both irradiated to a condition that closed the fuel-clad gap. The advantage of the high conductivity of the metal fuel is clearly evident; the maximum cladding temperatures are considerably lower than for the oxide elements with the same circumferential blockage extent. Also, the minimum cladding temperature at the opposite side of the element is higher for the metal fuel, thus providing more uniform heat rejection from the unblocked portion of the cladding. The cladding temperatures at the edge of the blockages for the oxide elements are directly proportional to the blockage angle, indicating that the cladding is the main path for heat rejection.

518 **Signal validation using simultaneous consistency checking of multivariable measurements.** Gloeckler, O.; Morgenstern, V.M.; Upadhyaya, B.R. *Transactions of the American Nuclear Society (USA),* 57: 153-154 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Since the incident at Three Mile Island Unit 2, computerized plant status display, human factors in control room design, and other plant monitoring tools available to plant personnel have seen a tremendous growth. One such proposed operator aid is a plant signal validation system. The objectives of the multivariable signal consistency checking are (a) to separate sensor faults (bias, decalibration) from normal changes in the multivariable system and (b) to detect and isolate common-mode sensor failures. The generalized consistency checking of multivariate redundant measurements (GCCM) network logic has several levels. The GCCM is being tested using both a simulated and an operational pressurized water reactor data base. A case in point occurs when a majority of the direct redundant measurements of several process variables have failed simultaneously by a common node. The numerical experiments showed that such multivariable common-mode failures can be detected by the GCCM approach. Also, a systematic and detailed sensitivity test is needed to improve the reliability of the method.

519 **Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample.** Mulpuru, S.R.; Pellow, M.D.; Barrand, R.D.; Hunt, C.E.L.; Iglesias, F.C.; Dickson, L.W. *Transactions of the American Nuclear Society (USA),* 57: 156-157

(1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The research program on Canada deuterium uranium (CANDU) reactor safety under postulated severe accidents includes studies on aerosol formation, transport, and associated fission product retention in the reactor primary heat transport system. As part of these studies, aerosol particles formed during steam-oxidation of a hot, irradiated UO_2 sample were collected and analyzed. The radioactive particles were collected using a specially built fine-wire impactor and were subsequently examined in a shielded facility using scanning electron microscopy. This paper presents the characteristics of the collected aerosol particles.

520 **The role of NUREG-1150 in accident management.** Camp, A.L.; Cramond, W.R.; Sype, T.T. *Transactions of the American Nuclear Society (USA),* 57: 158-159 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The NUREG-1150 report is being prepared by the US Nuclear Regulatory Commission and its contractors to estimate the risk from five commercial light water reactors: Surry, Sequoyah, Peach Bottom, Grand Gulf, and Zion. Level-3 probabilistic risk assessments (PRAs) are being prepared for each of these plants. These PRAs provided a framework for evaluating accident management alternatives from a risk standpoint. This paper describes the accident management benefits that NUREG-1150 is providing.

521 **Considerations for severe-accident management strategies in a pressurized water reactor.** Carbajo, J.J. (IT Corp., Oak Ridge, TN (USA)); Carter, J.C. *Transactions of the American Nuclear Society (USA),* 57: 159-160 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper presents results of a sensitivity study for potential recovery actions during a station blackout severe accident in a pressurized water reactor (PWR). The accident progression for each of the recovery actions was calculated by a modified version of the severe-accident integrated analysis code MAAP 3.0B. According to MAAP calculations for a station blackout in a PWR, vessel failure can be avoided if the power is recovered between 9500 s (2.6h) and 9800 s (2.7 h) after accident initiation (depending on reflood flow rate) and the core is immediately reflooded. If the power is recovered after 10 000 s (2.8 h), vessel failure cannot be avoided. Finally, there is a time window of 26 h between vessel failure and containment failure for actions that could prevent containment failure.

522 **Depressurization to mitigate direct containment heating.** Chambers, R.; Hanson, D.J.; Dallman, R.J.; Odar, F. *Transactions of the American Nuclear Society (USA),* 57: 160-161 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Direct containment heating (DCH) can potentially occur during certain pressurized water reactor (PWR) severe accidents after core melt and high-pressure melt ejection from the reactor pressure vessel (RPV). Molten core material is dispersed into the containment and a rapid transfer of energy to the containment atmosphere follows. The resultant rise in the temperature and pressure could cause the containment to fail relatively early in the accident sequence. Depressurization of the reactor coolant system (RCS) is a proposed accident management strategy to reduce the DCH contribution to early containment failure. An analysis evaluating the effectiveness of this strategy has been conducted. The capability to depressurize a three-loop PWR during a TMLB' sequence (loss of alternating current power and feedwater) using the pressurizer power-operated relief valves (PORVs) and the RPV head vent was analyzed using the SCDAP/RELAP5 computer code.

523 **Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document.** Plys, M.G. *Transactions of the American Nuclear Society (USA),* 57: 161-162 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Hydrogen could be a significant contributor to severe-accident risk if hydrogen generation and combustion were to lead to containment failure and resulting release of fission products. To eliminate hydrogen as a significant risk contributor for advanced light water reactors (ALWRs), the Electric Power Research Institute (EPRI) ALWR requirements document has imposed a hydrogen control requirement. This requirement specifies an upper limit of 13 dry vol% for the allowable hydrogen concentration in containment. The requirement also considers hydrogen generation during severe accidents and states an upper bound on the hydrogen source equivalent to that generated by oxidizing 75% of the active cladding [commonly stated as 75% metal/water reaction (MWR)]. The purpose of this paper is to technically support and substantiate the EPRI ALWR hydrogen requirement. The current understanding of hydrogen generation and combustion is evaluated as it applies to reactor systems, and it is concluded that both experimental results and analytical methods provide a sound technical basis for the requirement.

524 **The radiological impact of the Chernobyl accident.** Konstantinov, L.V.; Gonzalez, A.J. *Transactions of the American Nuclear Society (USA),* 57: 163 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The purpose of this paper is to summarize the international assessments of the radiological impact of the Chernobyl accident. The Chernobyl accident was a technological disaster that went beyond the most pessimistic scenarios of nuclear engineers. It was more sever than a maximum credible accident to which nuclear engineers referred before it happened. In spite of its severity, the consequences of the accident at Chernobyl, seen in perspective, seem not to be so catastrophic. The number of fatalities was small compared with the figures for other common types of accidents, and the radiation doses incurred are only a small fraction of those inevitably incurred due to natural background radiation.

525 **Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident.** Koehler, H. *Transactions of the American Nuclear Society (USA),* 57: 164-165 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The BIOMOVS study deals with the validation of environmental assessment models for the biosphere. Within the framework of the study, predictions of the contamination of milk by ^{131}I and of milk, beef, and grain by ^{137}Cs were compared with independent observations from the Chernobyl accident. For that purpose, site-specific information has been collected from 13 locations in the Northern Hemisphere. The necessary source terms and background information were offered to participants, and observed results were not distributed until after predictions had been made in order to keep it a blind test. Calculations have been performed by 18 separate groups of scientists using 23 different models. Analysis of the very large amount of data generated in the exercise is still going on and finalization is planned for 1989-90. The sites from which data have been collected are in Finland, Sweden, Denmark, Netherlands, Belgium, the Federal Republic of Germany, Italy, Hungary, India, Japan, and the United States. In addition to the analysis and validation of models, the observations from these sites already allow some interesting conclusions. The deposition data indicate that the iodine intercepted by vegetation is rather independent of the amount of rainfall, while there is a high correlation between rainfall and cesium contamination of pasture vegetation. Normalizing the radionuclide concentrations in pasture vegetation and milk by the air concentrations, remarkably consistent values are derived for all locations and do not differ by more than factors of 3 to 8.

526 **Implications of the Chernobyl accident for US reactors.** Miller, C.W.; Wight, R.R.; Blackburn, J.B.; Plaskon, L.A. *Transactions of the American Nuclear Society (USA),* 57: 166-167 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The accident that occurred at unit 4 of the nuclear power station at Chernobyl in the USSR on April 26, 1986, was the worst accident in the history of nuclear power. Thirty-one workers and emergency

personnel died and more than 200 were hospitalized as a result of this event. Approximately 135,000 persons within 30 km around the reactor were evacuated, and radioactive debris was spread throughout the Northern Hemisphere. There was much public concern generated around the world, and an increased risk of fatal cancer in the world;s population is possible as a result of exposure to Chernobyl fallout. The purpose of this paper is to present some of the major lessons that the Illinois Department of Nuclear Safety (IDNS) believes can be learned from the Chernobyl accident. The IDNS has identified five major areas where implications can be drawn from Chernobyl for US reactors: (a) administrative controls, (b) reactor design, (c) containment, (d) emergency planning, and (e) severe accident phenomena. It is clear that administrative controls in place at Chernobyl did not work.

527 **Effectiveness of cleanup criteria relative to an accidental nuclear release.** Chen, S.Y.; Yuan, Y.C. *Transactions of the American Nuclear Society (USA),* 57: 167-169 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the event of an accidental nuclear release, the associated long-term radiological risks would result primarily from ground contamination pathways. Cleanup of the contaminated ground surfaces is a necessary step toward reducing the radiological risk to the general population. Ideally, the radiological risk decreases as the level of cleanup effort increases; however, as the cleanup criterion (i.e., the required contaminant concentration after cleanup) becomes more stringent, the cleanup effort may become prohibitively costly. This study examines several factors that are important in determining the effectiveness of the cleanup criteria for selected radionuclides: (a) annual individual dose commitment (mrem/yr), (b) total population environmental dose commitment (person-rem), and (c) total area (km_2) requiring cleanup following an accident. To effectively protect the general population, the benefits of cleanup should be weighed against the potentially large increase in cleanup area (and the associated costs) as the cleanup criterion becomes more stringent. The effectiveness of cleanup will vary, depending largely on site-specific parameters such as population density and agricultural productivity as well as on the amount and type of radionuclide released. Determination of an optimum cleanup criterion should account for all factors, including a comprehensive cost/benefit analysis.

528 **Corrections for graphite-induced problems in N reactor.** Toffer, H.; Crowe, R.D.; Fortner, R.L. *Transactions of the American Nuclear Society (USA),* 57: 170-171 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Graphite is an excellent neutron moderator and is extensively used in reactor designs throughout the world. The material has many advantages, such as permitting more efficient fuel utilization, desirable structural features, and a large heat capacity to serve as an ultimate heat sink during severe accidents. However, there are drawbacks to the use of graphite moderators, such as distortion due to long-term neutron exposure. Proper selection of the type of graphite and special design features can compensate for inhomogeneous growth or shrinkage over the design life of a nuclear plant. Operating experience with the Hanford N Reactor, a graphite-moderated reactor, and corrective actions implemented to compensate for graphite-related problems are discussed. Two particular issues, the loss of balls from the backup safety system and moderator growth in the vertical direction, and their resolution are described. Loss of safety balls to the moderator space was solved through maintenance and ball replacement. Vertical stack distortion due to graphite expansion was retarded by a special flux tailoring program. As a result of these efforts, improved ability exists to operate the reactor safely 3 to 4 yr beyond its design life.

529 **Reactor coolant seal testing under station blackout conditions.** Marsi, J.A. *Transactions of the American Nuclear Society (USA),* 57: 172-173 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Failures of reactor coolant pump (RCP) seals that could result in a significant loss-of-coolant inventory are of current concern to the US Nuclear Regulatory Commission. Particular attention is being focused on seal behavior during station blackout conditions, when failure of on-site emergency diesel generators occurs simultaneously with loss of all off-site alternating current power. Under these conditions, both seal injection flow and component cooling water flow are lost, and the RCP seals are exposed to full reactor coolant temperature. Overheating of elastomeric components and flashing of coolant across the sealing faces can cause unacceptably high leakage rates, with potential catastrophic consequences. A test program has been conducted that subjects full-scale seal cartridges to typical pressurized water reactor (PWR) coolant system steady-state and transient operation conditions including associated dynamic shaft motions. A special test segment was developed to evaluate seal operation under station blackout conditions. The test program successfully mirrored the severity of an actual loss-of-seal cooling water event under station blackout conditions, and the Byron Jackson® N-9000 seal cartridge maintained its integrity.

530 **Reactivity calculations of the Chernobyl accident.** Martinez-Val, J.M.; Aragones, J.M. *Transactions of the American Nuclear Society (USA),* 57: 177-178 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The objective of this study was to analyze the physical causes of the Chernobyl accident, in particular, the role of reactivity effects along its evolution. The best source of information about the accident is the official report presented by the Soviet authorities at the International Atomic Energy Agency meeting in August 1986, but it had to be completed with earlier papers on the physics of RBMK reactors, including some articles on reactivity effects. Reactivity coefficients were calculated with WIMS-D4 in a multicell scheme to take into account different ratios of fuel channels to control and water channels. The most critical effect in RBMK reactors is the water density coefficient. The graphite reactivity coefficient was also positive in the quasi-steady state but it did not play a significant role in the accident because the graphite temperature varied very slowly (<1°C per 800°C rise in fuel temperature). Xenon reactivity effects were of interest before the accident itself, but their influence was null during the reactivity trip. It can be concluded from this analysis that the initiating mechanism was primarily related to the pressure drop at the reactor inlet after starting the experiment on the generator trip, together with the positive void coefficient in the nuclear conditions. It is work emphasizing that an undermoderated light water reactor cannot undergo this type of sequence of events, which is very specific of overmoderated reactors with a solid main moderator.

531 **A comprehensive approach to RCM-based preventive maintenance program development.** Hall, B.E.; Davis, T.; Pennington, A.J. *Transactions of the American Nuclear Society (USA),* 57: 182-182 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In late 1986, Public Service Electric and Gas Company (PSE&G) concluded that to support its vision and strategic planning it would be necessary to develop a consistent approach to maintenance for all nuclear units at the artificial island. General Physics Corporation was selected to lead a consultant team to support full-scale development of a preventive maintenance (PM) program for Salem and Hope Creek generating stations based on a reliability-centered maintenance (RCM) approach. RCM was selected because it represents a systematic approach to developing a PM program that provides a logical, consistent, and traceable methodology and produces a well-documented engineering basis for the program. Early in 1987, primary objectives for the PM program were defined. The Phase I tasks addressed key programmatic areas such as maintenance philosophy, procedures, condition monitoring, performance trending, equipment failure data base, ogranization, PM program effectiveness evaluation, RCM process, reliability/availability modeling, information management, training, spare parts, software/hardware, and commitments. Phase I of the PM program development project was completed in January 1988. Highlights of the Phase I work and the PM program manual are described.

532 **Evaluation of the consequences of containment bypass scenarios.** Fuller, E.L.; Hessian, R.T.; Henry, R.E. *Transactions of the American Nuclear Society (USA),* 57: 194-195 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Fission product transport and deposition in auxiliary and secondary containment buildings are important considerations in severe-accident analysis. Accordingly, a methodology has been developed that can be used to evaluate such fission product retention. Accident sequences considered include containment bypass scenarios and others that involve fission products being released from the containment into an adjacent building. The following were produced: (a) a list of plant-specific features that have a major influence of fission product retention; (b) a catalog of the pertinent auxiliary building/reactor building configurations sufficient to allow utilities to perform their own analyses; (c) a model for the building circulatory flows, both natural and forced, which allows arbitrary nodalization and has been experimentally verified; and (d) analyses of the sequences for the major variations in design. Fission product releases to the environment are principally governed by building response. Other important factors include the following: (1) auxiliary building size; (2) building compartmentalization and position of door jambs; (3) junction flow area to the environment; (4) operability of ventilation systems; (5) scrubbing through water pools covering the release point; (6) water sprays.

533 **LWR fuel rod bundle behavior under severe fuel damage conditions.** Kuczera, B. Hagen, S.; Hofmann, P. *Transactions of the American Nuclear Society (USA),* 57: 155-156 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Light water reactor (LWR) safety research and development activities conducted at Kernforschungszentrum Karlsruhe have recently been reorganized with a concentrated mission under the LWR safety project group. The topics treated relate mainly to severe-accident analysis research and source term assessment as well as to source term mitigation measures. A major part of the investigations concerns the early phase of a severe core meltdown accident, specifically LWR rod assembly behavior under sever fuel damage (SFD) conditions. To determine the extent of fuel rod damage, including the relocation behavior of molten reaction products, damage propagation, time-dependent H_2 generation from clad oxidation, and fragmentation of oxygen-embrittled materials during cooldown and quenching, extensive out-of-pile rod bundle experiments have been initiated in the new CORA test facility. The bundle parameters, such as rod dimensions, rod pitch, and grid spacer, can be adjusted to both pressurized water reactor (PWR) and boiling water reactor (BWR) conditions. Currently, the test program consists of 15 experiments in which the influence of Inconel grid spacer, (Ag,In,Cd)-absorber rods (PWR) and of B_4C control blades (BWR) on fuel damage initiation and damage propagation are being investigated for different boundary conditions. As of June 1988, four bundle tests had been successfully carried out for PWR accident conditions.

534 **Event sequence of a severe accident in a single-unit CANDU reactor.** Dick, J.E.; Min, T.K.; Kohn, E.; Prawirosoehardjo, S. *Transactions of the American Nuclear Society (USA),* 57: 157-158 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Atomic Energy of Canada recently performed an assessment of several severe accident scenarios in single-unit Canada deuterium uranium (CANDU) nuclear power reactors. This reports on the examination and consequences of a dominant core-melt sequence.

535 **Economic consequences of the Chernobyl accident in Norway in 1986 and 1987.** Tveten, U. *Transactions of the American Nuclear Society (USA),* 57: 163-164 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the accident consequence assessment (ACA) area there is extensive cooperation between the Nordic countries (Denmark, Finland, Norway, and Sweden), performed within the Nordic Safety Program, and partially funded by the Nordic Council of Ministers, via the Nordic Liaison Committee for Atomic Energy. One of the 17 projects in the ACA-related program area is concerned with the economic consequences of the Chernobyl accident in Finland, Norway, and Sweden. This paper is limited to describing conditions in Norway. There are areas in Norway where the Chernobyl fallout is >100 kBq/m^2, and the total amount of radiocesium deposited over Norway is estimated by the National Institute for Radiation Hygiene to be 6% of the radiocesium released from the reactor. The areas where ground concentrations are highest are mostly in sparsely populated mountain areas. These areas are, however, important in connection with several nutritional pathways, notably, sheep, goats, reindeer, and freshwater fish. The purpose of this paper is to summarize information on mitigating actions and economic consequences of the deposited radioactive materials to Norwegian agriculture in the 1986-87 and 1987-88 slaughtering periods.

536 **Update and comparisons of dose estimates following the Chernobyl accident.** Hull, A.P. *Transactions of the American Nuclear Society (USA),* 57: 165-166 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In June 1987 the US Department of Energy (DOE) published a report containing estimates of individual and collective doses to the population of the entire Northern Hemisphere from the radioactivity released during the Chernobyl accident. This paper considers the updating of DOE dose estimates, as necessitated principally by reductions in the Soviet dose estimates. In addition, it compares the several estimates by the U.K. Atomic Energy Authority (UKAEA), CEC, OECD, and UNSCEAR for the dose to the European population, along with a consideration of reasons for their differences.

537 **Maanshan small-LOCA analysis.** Chen, C.C.; Wang, T.K.; Chiang, S.C. *Transactions of the American Nuclear Society (USA),* 57: 173-174 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

According to Maanshan Unit 1 plant probabilistic risk assessment (PRA), the small loss-of-coolant accident (LOCA) S_2WH is ranked third in frequency among postulated accidents. Maanshan-1 is a 2775-MW (thermal), three-loop Westinghouse pressurized water reactor with large dry containment. The sequence S_2WH is defined as a small LOCA S_2, loss of residual heat removal (RHR) cooling W, and loss of low-head safety recirculation H. All the results reported are based on MAAP 3.2 calculations. In addition to a base case study, calculations were made based on changes in the LOCA break area, fan cooler availability, and injection capability (in case C). Comparisons between the base case and other cases can then be used to assess the vessel and containment behavior under various plant conditions. In addition to the above S_2WH studies, another calculation was performed on the assumption that both high- and low-head injection were unavailable. By PRA definition, this is the S_2DJ accident (case C). To compare with the S_2WH accident, the loss of both high- and low-head injections caused core uncovery and vessel failure to occur at an earlier time. The conclusions are summarized.

538 **Steel and concrete containment models: Analyses and tests conducted to failure.** Horschel, D.S. *Transactions of the American Nuclear Society (USA),* 57: 195-196 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the wake of the Three Mile Island incident, attention was focused on the capability of the reactor containment building for loadings beyond its design basis. The containment building, whether it is made of steel, reinforced concrete, or prestressed concrete, is the last engineered barrier to prevent the release of fission products and radioactive gasses that could be generated during the severe-accident loading conditions. Containments are designed to withstand accident conditions and environmental loadings, such as loss-of-coolant accident and earthquake loadings. The containment function not only relies on its structural capabilities but also on its leaktightness. To investigate the performance of containment buildings for nuclear reactors, Sandia National Laboratories (SNL) has been engaged in an experimental and analytical effort to assess the

behavior of containments subjected to pneumatic overpressurization. The objective of this program is to qualify analytical methods using experimental data, so that the analytical tools can be used to assess full-sized containment structures when subjected to a variety of accident scenarios. The major area of testing has been scale-model containment structures, but testing has also included other containment components that are critical to the containment structure, such as seals, gaskets, and full-sized electrical penetration assemblies and personnel air locks.

539 **A critique of three methodologies for estimating the probability of containment failure due to steam explosions.** Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). *Nuclear Science and Engineering (USA),* 96(3): 173-191 (Jul 1987).

At least three distinct approaches have been employed for estimating the conditional probability of containment failure due to steam explosions within the pressure vessel of a water-cooled nuclear reactor. These approaches, which involve varying degrees of subjectivity and objectivity, are reviewed in this article. It is concluded that, given the current state of knowledge, all approaches involve significant uncertainties; no method is currently capable of credibly defending any given value of failure probability or a narrow uncertainty range.

540 **Fluence-to-dose conversion factor standards.** Kaul, D.C. *Transactions of the American Nuclear Society (USA),* 57: 214-215 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The American Nuclear Society (ANS) publishes data that have been reviewed and approved for use as a reference standard under the auspices of the American National Standards Institute (ANSI). In 1977 the ANS published American National Standard Neutron and Gamma-Ray Flux-to-Dose-Rate Factors, which provided the means for computing dose values pertinent to radiation protection from externally incident neutron and gamma-ray flux values calculated in the process of shield analysis and design. That standard, unchanged and in effect for 11 yr, is now in the process of revised by the ANS and its standards working group 6.1.1, of which the author is chair. The revision process has had to await the availability of suitable data to replace that originally recommended by the National Council on Radiation Protection and Measurement and incorporated in the current standard. Such data, conforming to definitions propounded by the International Commission on Radiological Protection (ICPR) and the International Commission on Radiation Units and Measurements (ICRU), are now available for consideration. This paper provides a comparison of the available data with those in current standard, as well as a rationale for selecting data for incorporation in the revised standard.

541 **Comparison of radiation sources from selected point depletion codes.** Brady, M.C. (Oak Ridge National Lab., TN (USA)); Hermann, O.W.; Wilson, W.B. *Transactions of the American Nuclear Society (USA),* 57: 226-229 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Three radionuclide inventory/depletion codes, ORIGEN2, ORIGEN-S, and CINDER-2, were chosen to be used in a study to compare and to assess the performance of both neutron and photon source spectra in a shielding analysis of a typical spent-fuel cask. The comparisons were made for a series of five test cases involving light water reactor (LWR) models [three pressurized water reactors (PWRs) and two boiling water reactors (BWRs)] at cooling times ranging from 30 days to 50 yr. The results of this comparison of photon and neutron source strengths and the application of the source spectra in a typical shielding problem suggest that the differences among the three codes may be attributed to differences in the data libraries and not in the methodology applied in each of these codes.

542 **Tramp uranium.** Hendrixson, E.S.; Williamson, T.G. *Transactions of the American Nuclear Society (USA),* 57: 229-230 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Many utilities have implemented a no leaker philosophy for fuel performance and actively pursue removing leaking fuel assemblies from their reactor cores whenever a leaking fuel assembly is detected. Therefore, the only source for fission product activity in the RCS when there are no leaking fuel assemblies is tramp uranium. A technique has been developed that strips uranium impurities from $ZrCl_4$. Unless efforts are made to remove natural uranium impurities from reactor materials, the utilities will not be able to reduce the RCS specific ^{131}I activity in PWRs to below the lower limit of ~1.0 x 10^{-4} $\mu Ci/g$.

543 **Simplified determination of radiation environment outside BSW penetrations.** Bhatnagar, S.K. *Transactions of the American Nuclear Society (USA),* 57: 230-231 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The stringent requirements imposed on equipment in a nuclear power plant due to the assumption of an end-of-life loss-of-coolant accident and the required operation of equipment in order to ensure a safe shutdown of the plant disallow a very conservative evaluation of the radiation environments inside the containment building. Due to a slow decrease in radiation level with respect to vertical offset from the core midplane, the neutron and gamma radiation fields in the vicinity of biological shield wall (BSW) penetrations are expected to be more intense than those across BSW at core midplane. An evaluation of the radiation environment outside a penetration is essentially a three-dimensional problem. An approach has been developed by Stone & Webster Engineering Corporation and is named the isotropic analog method (IAM). The modified IAM can be used to provide an economical, yet conservative, estimation of radiation fields in the drywell of BWRs using vertical offset reduction factors with respect to core midplane and changes due to angular distribution. This will yield realistic radiation environments for the qualification of equipment.

544 **Image reconstruction for a radiation-field mapping system.** Gould, R.; Kenney, E.S. *Transactions of the American Nuclear Society (USA),* 57: 231-232 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A prototype device for producing an iso-dose map of the radiation field due to an arbitrary source distribution has been constructed. Such a device would automate radiation surveys, greatly reducing expenditures in person-hours and person-rems for radiation workers. An automated survey system would be very useful in nuclear power plants, radioactive waste disposal sites, medical irradiation facilities, and radiochemical laboratories. Because of the authors interest in high-radiation fields, the system employs a pair of collimated ionization chambers mounted on a scanning carriage. Ionization chambers were chosen for their durability in a hostile environment, such as a boiling water reactor dry well. The measurement process is composed of a series of scanner rotations and translations and is similar to that used for medical computed tomography imaging. A simple trigonometric algorithm was used to produce a two-dimensional map from radiation intensity and position data. These maps, although providing proof of principle, were highly artifacted due to the small number of scanning carriage locations constrained by the small size of the hot cess in which the device is operated.

545 **Discharge of ^{41}Ar from a neutron activation analysis facility.** Micklich, B.J.; Williams, J.G.; Barss, N.M.; Neuhoff, J.W.; Aleksick, R.M. *Transactions of the American Nuclear Society (USA),* 57: 235-236 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Normal operation of research reactors results in the production of ^{41}Ar by neutron capture in the ^{40}Ar naturally present in air. At the University of Illinois this activity is vented through a stack on the roof of the reactor building and is monitored to verify compliance with the concentration limits specified in the operating licenses for the reactors. In addition to the releases from the reactor building roof, small amounts of ^{41}Ar can be discharged from the roof of the adjacent materials research laboratory (MRL) as a result of the operation of a pneumatic sample transfer system used in neutron activation analysis. Because of a planned increase in the use of this

facility, a program of monitoring and dose calculations was instituted to assure compliance with 10CFR20. In addition to satisfying the limits on the concentration of ^{41}Ar at the boundary, the authors have performed calculations of the maximum dose rate at the edge of the MRL building roof, which is the proposed boundary of the restricted area. Environmental monitoring by means of lithium fluoride thermoluminescent dosimeters has also been initiated to demonstrate that an individual continuously present at the boundary of the restricted area could not receive a total dose equivalent >100 mrem/yr as a result of facility operation. Results from the first 3 months of monitoring (during which time no ^{41}Ar was released from the MRL roof) show a mean monthly dose equivalent of 12 mrem on the MRL roof.

546 Acoustic monitoring of BWR main steam safety relief valves. Sano, Kenichi; Koyama, Kazuhiko; Matsunaga, Yukuo; Kojima, Akira; Sakai, Kiyoshi. *Transactions of the American Nuclear Society (USA),* 57: 247-248 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Main steam safety relief valves (SRVs) are important equipment in boiling water reactor plants, so monitoring of leakage and valve opening of SRVs is also important. To detect leakage and valve opening, thermocouples are installed on exhaust pipes and limit switches or position sensors on valve stems. The acoustic detection technique with AE sensors and accelerometers is adopted not only to increase the accuracy and response speed of leak detection, but also to estimate leak rate and to detect valve opening. The acoustic leak detection technique was found effective by the mock-up experiment in which an actual SRV and steam under the same condition as the actual use were used to measure the signals from AE sensors and accelerometers attached to the SRV with artificial cuttings on its thermal disk. The acoustic monitoring tests of SRVs have been carried out at a nuclear power plant to prove the acoustic leak detection technique to be effective. The results of the acoustic monitoring tests at the plant are discussed. As a result of the on-site test, the acoustic leak monitoring system was found effective in the plant.

25 ENERGY STORAGE

2506 Thermal

Refer also to citation(s) 276, 716

547 (ESA-TT–1107) **Material degradation in a barium hydroxide latent heat storage pilot unit.** Krause, S.; Vonbradke, M.L. European Space Agency, 75 - Paris (France). Jan 1989. 65p. (DFVLR-FB–87-49;ETN–89-94443). Available from NTIS, PC A04/MF A01; original German version available from DFVLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, DM 29.50.

Barium hydroxide's chemical interaction with the heat transfer oil, the stainless steel container, and the ambient air was investigated in a pilot storage unit. Chemical analysis, and electron microscope, and EDX were applied. Degradations observed after 40 test months are remarkably small. Long useful lives may therefore be expected for practical latent heat storage plants. The results also concern latent heat storage at high temperatures in solar dynamic energy systems in space, where the latent heat storage medium and its container also interact.

2509 Batteries

548 (AD-A–210024/6/XAB) **Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989.** Vaughn, R.L. Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA). Jun 1989. 28p. (FJSRL-TM–89-0003). Available from NTIS, PC A03/MF A01.

BATTERY.BAS is a BASIC program that automatically executes battery-cycling experiments, takes voltage-current data, monitors open-circuit voltage, and some combinations of these tests. Since the program is written in interpretive BASIC, the user has the flexibility to modify some experimental parameters while the experiment is in progress. Data are saved in various sequential ASCII files that can be accessed by any program that can read ASCII files. SlideWrite Plus (Advanced Graphics Software, Inc.), for example, is used for graphical presentation of data. Some utility programs are included to manipulate data collected by the program. Typical manipulations are separation of individual cycles from multiple-cycle data and conversion of voltage-time data to voltage-charge data.

549 (EGG-EP–8656) **Laboratory testing of Sonnenschein DF6V180 6 volt traction battery.** Hardin, J.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jul 1989. 23p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002080. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this report is to describe the testing performed on the Sonnenschein DF6V180 sealed lead-acid 6 volt traction battery by the INEL Electric Vehicle Battery Laboratory, to present the results and conclusions of this testing, and to make appropriate recommendations. 14 figs., 3 tabs.

550 (EPRI-AP–6012-SR, pp. 20.1-20.13) **Glass electrolytes and some of their applications.** Bloom, I. (Argonne National Lab., IL (USA)); Hash, M.C.; Heiberger, J.J.; Internoscia, M.A.; Rea, K.; Redey, L. Electric Power Research Inst., Palo Alto, CA (USA). Oct 1988. DOE Contract W-31-109-ENG-38. (CONF-8806127–: 7. DOE/EPRI beta (sodium/sulfur) battery workshop, Toronto (Canada), 1-3 Jun 1988). In *DOE/EPRI beta (sodium/sulfur) battery workshop VII: Proceedings.* Order Number DE89003034. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

For some time, ceramic electrolytes, such as β-, β''-alumina, and NASICON have been under development for use as the electrolyte in sodium-based electrochemical cells and as the membrane in electroanalytic devices. Typically, they have low ionic resistivities (ca. 5 to 10 { OMEGA} x cm at 300°C) but are expensive to fabricate. Cells containing these electrolytes have a single electrolyte tube a few centimeters in diameter. Sodium-ion-conducting glasses are a promising alternative to the ceramic electrolytes. The glasses offer more compositional versatility than the ceramic. This allows the glass to be tailored to the specific application. Glasses are, generally, easier and less expensive to fabricate into desired shapes than ceramics. The glass upon which the most development work has been done is a modified sodium borate glass, Na_2O-$2B_2O_3$-$0.2SiO_2$-0.16NaCl, called Dow Glass, which has an ionic resistivity of about 2×10^4 { OMEGA} x cm at 300°C. Because of its high resistivity, cells using this glass require thousands of hollow glass fibers, each 80 μm in diameter (15 μm wall thickness). In spite of its greater complexity, the cell with the glass electrolyte is of interest because of its potential for lower cost and higher power. The development of these glass electrolytes is described.

551 (N–89-22982, pp. 3) **The importance of batteries in unmanned missions.** Klein, J.W. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

A brief overview of the current set of unmanned missions that are currently in operation and those planned for the next 5 to 10 years was presented. The important role of batteries in the development of successful missions was discussed. The workhorse battery, the NiCd, and its use throughout historical missions was explored. Its role on Observers and Landers was discussed, and the success those batteries had. The recent events in the issues of quality and life for NiCd batteries were discussed. These discussions focused on the current design activities for Mars Observer (MO), TOPEX, and Mariner Mark II. Separator selection and the need for uniform testing procedures to develop a quality battery product that can perform to mission requirements were discussed. The recent experiences with the GRO battery failure and the other events have led JPL to the decision to develop a testing program in conjunction with other NASA centers to determine the best separator material for these two missions. The decision for separator material and battery

design must be made a year from now. Thus there will not be time to perform a total 2-year accelerated test. The JPL plan for coping with this compromise was discussed. A discussion of where NiH2 batteries are beginning to have an impact and the difficulties with their implementation were addressed. Such missions at Earth Observing System (EOS) and the NOAA series of satellites rely upon NiH2 for success but were not chosen for TOPEX or MO due to their large volume requirements.

552 (N–89-22982, pp. 6) **A survey of advanced battery systems for space applications.** Attia, A.I. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The results of a survey on advanced secondary battery systems for space applications are presented. The objectives were: to identify advanced battery systems capable of meeting the requirements of various types of space missions, with significant advantages over currently available batteries, to obtain an accurate estimate of the anticipated improvements of these advanced systems, and to obtain a consensus for the selection of systems most likely to yield the desired improvements. Few advanced systems are likely to exceed a specific energy of 150 Wh/kg and meet the additional requirements of safety and reliability within the next 15 years. The few that have this potential are: (1) regenerative fuel cells, both alkaline and solid polymer electrolyte (SPE) types for large power systems; (2) lithium-intercalatable cathodes, particularly the metal ozides intercalatable cathodes (MnO2 or CoO2), with applications limited to small spacecrafts requiring limited cycle life and low power levels; (3) lithium molten salt systems (e.g., LiAl-FeS2); and (4) Na/beta Alumina/Sulfur or metal chlorides cells. Likely technological advances that would enhance the performance of all the above systems are also identified, in particular: improved bifunctional oxygen electrodes; improved manufacturing technology for thin film lithium electrodes in combination with polymeric electrolytes; improved seals for the lithium molten salt cells; and improved ceramics for sodium/solid electrolyte cells.

553 (N–89-22982, pp. 7) **Novel nitrogen-based organosulfur electrodes for advanced intermediate temperature batteries.** Visco, S.J.; Dejonghe, L.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Advanced secondary batteries operating at intermediate temperatures (100 to 200 C) have attracted considerable interest due to their inherent advantages (reduced corrosion and safety risks) over higher temperature systems. Current work in this laboratory has involved research on a class of intermediate temperature Na/beta double prime- alumina/RSSR batteries conceptually similar to Na/S cells, but operating within a temperature range of 100 to 150 C, and having an organosulfur rather than inorganic sulfur positive electrode. The organosulfur electrodes are based on the reversible, two electron eduction of organodisulfides to the corresponding thiolate anions, RSSR + 2 electrons yield 2RS(-), where R is an organic moiety. Among the advantages of such a generic redox couple for battery research is the ability to tailor the physical, chemical, and electrochemical properties of the RSSR molecule through choice of the organic moiety. The viscosity, liquidus range, dielectric constant, equivalent weight, and redox potential can in fact be verified in a largely predictable manner. The current work concerns the use of multiple nitrogen organosulfur molecules, chosen for application in Na/RSSR cells for their expected oxidizing character. In fact, a Na/RSSR cell containing one of these materials, the sodium salt of 5-mercapto 1-methyltetrazole, yielded the highest open circuit voltage obtained yet in the laboratory; 3.0 volts in the charged state and 2.6 volts at 100 percent discharge. Accordingly, the cycling behavior of a series of multiple nitrogen organodisulfides as well as polymeric organodisulfides are presented in this manuscript.

554 (N–89-22982, pp. 8) **Advanced rechargeable sodium batteries with novel cathodes.** Distefano, S.; Ratnakumar, B.V.; Bankston, C.P. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Various high energy density rechargeable batteries are being considered for future space applications. Of these, the sodium-sulfur battery is one of the leading candidates. The primary advantage is the high energy density (760 Wh/kg theoretical). Energy densities in excess of 180 Wh/kg were realized in practical batteries. Other technological advantages include its chemical simplicity, absence of self-discharge, and long cycle life possibility. More recently, other high temperature sodium batteries have come into the spotlight. These systems can be described as follow: Na/Beta Double Prime-Al2O3/NaAlCl4/Metal Dichloride Sodium/metal dichloride systems are colloquially known as the zebra system and are currently being developed for traction and load leveling applications. The sodium-metal dichloride systems appear to offer many of the same advantages of the Na/S system, especially in terms of energy density and chemical simplicity. The metal dichloride systems offer increased safety and good resistance to overcharge and operate over a wide range of temperatures from 150 to 400 C with less corrosion problems.

555 (N–89-22982, pp. 10) **The electrochemical generation of useful chemical species from lunar materials.** Tsai, K.J.; Kuchynka, D.J.; Sammells, A.F. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The current status of work on an electrochemical technology for the simultaneous generation of oxygen and lithium from a Li2O containing molten salt (Li2O-LiCl-LiF) is discussed. The electrochemical cell utilizes an oxygen vacancy conducting solid electrolyte, yttria-stabilized zirconia, to effect separation between the oxygen evolving and lithium reduction half-cell reactions. The cell, which operates at 700 to 800 C, possesses rapid electrode kinetics at the lithium-alloy electrode with exchange current density values being greater than 60 mA/sq cm, showing high reversibility for this reaction. When used in the electrolytic mode, lithium produced at the negative electrode would be continuously removed from the cell for later use (under lunar conditions) as an easily storable reducting agent (compared to H2) for the chemical refining of lunar ores via the general reaction: 2Li + MO yields Li2O + M where MO represents a lunar ore. Emphasis to this time has been on the simulated lunar ore ilmenite (FeTiO3), which we have found becomes chemically reduced by Li at 432 C. Furthermore, both Fe2O3 and TiO2 have been reduced by Li to give the corresponding metal. This electrochemical approach provides a convenient route for producing metals under lunar conditions and oxygen for the continuous maintenance of human habitats on the Moon's surface. Because of the high reversibility of this electrochemical system, it has also formed the basis for the lithium-oxygen secondary battery. This secondary lithium-oxygen battery system posses the highest theoretical energy density yet investigated.

556 (N–89-22982, pp. 11) **A new concept for high-cycle-life LEO: Rechargeable MnO_2-hydrogen.** Appleby, A.J.; Dhar, Y.J.; Murphy, O.J.; Srinivasan, S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The nickel-hydrogen secondary battery system is now the one of choice for use in GEO satellites. It offers superior energy density to that of nickel-cadmium, with a lifetime that is at least comparable in

terms of both cycle life and overall operating life. While the number of deep cycles required for GEO use is small, LEO satellites with long lifetimes (5 to 10 years) will require secondary battery systems allowing 30,000 to 60,000 useful cycles which are characterized by an approximately 2C charge rate and C average discharge rate. Recent work has shown that birnessite MnO2 doped with bismuth oxide can be cycled at very high rates (6C) over a very large number of cycles (thousands) at depths-of-discharge in the 85 to 90 percent range, based on two electrons, which discharge at the same potential in a flat plateau. The potential is about 0.7 V vs. hydrogen, with a cut-off at 0.6 V. At first sight, this low voltage would seem to be a disadvantage, since the theoretical energy density will be low. However, it permits the use of lightweight materials that are immune from corrosion at the positive. The high utilization and low equivalent weight of the active material, together with the use of teflon-bonded graphite for current collection, result in very light positives, especially when these are compared with those in a derated nickel-hydrogen system. In addition, the weight of the pressure vessel falls somewhat, since the dead volume is lower. Calculations show that a total system will have 2.5 times the Ah capacity of a derated nickel-hydrogen LEO battery, so that the energy density, based on 1.2 V for nickel-hydrogen and 0.7 V for MnO2-hydrogen, will be 45 percent higher for comparable cycling performance.

557 (N–89-22982, pp. 12-13) **Characterization testing of a 40 Ahr bipolar nickel hydrogen battery.** Brewer, J.C. (National Aeronautics and Space Administration, Lewis Research Center, Cleveland, OH (USA)); Manzo, M.A.; Gahn, R.F. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

In a continuing effort to develop NiH_2 bipolar technology to a point where it can be used efficiently in space flight, testing of a second 40 Ahr, 10-cell bipolar battery has begun. This battery has undergone extensive characterization testing to determine the effects of such operating parameters as charge and discharge rates, temperature, and pressure. The fundamental design of this actively cooled bipolar battery is the same as the first battery. Most of the individual components, however, are from different manufacturers. Different testing procedures as well as certain unique battery characteristics make it difficult to directly compare the two sets of results. In general, the performance of this battery throughout characterization produced expected results. The main differences seen between the first and second batteries occurred during the high-rate discharge portion of the test matrix. The first battery also had poor high-rate discharge results, although better than those of the second battery. Minor changes were made to the battery frame design used for the first battery in an attempt to allow better gas access to the reaction sites for the second build and hopefully improve performance. The changes, however, did not improve the performance of the second battery and could have possibly contributed to the poorer performance that was observed. There are other component differences that could have contributed to the poorer performance of the second battery. The H2 electrode in the second battery was constructed with a Goretex backing which could have limited the high-rate current flow. The gas screen in the second battery had a larger mesh which again could have limited the high-rate current flow. Small scale 2 x 2 batteries are being tested to evaluate the effects of the component variations.

558 (N–89-22982, pp. 31) **KOH concentration effect on the cycle life of nickel-hydrogen cells. 4: Results of failure analyse.** Lim, H.S.; Verzwyvelt, S.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Effects of KOH concentrations on failure modes and mechanisms of nickel-hydrogen cells were studied using long cycled boiler plate cells containing electrolytes of various KOH concentrations ranging 21 to 36 percent. Life of these cells were up to 40,000 cycles in an accelerated low earth orbit (LEO) cycle regime at 80 percent depth of discharge. An interim life test results were reported earlier in J. Power Sources, 22, 213-220, 1988. The results of final life test, end-of-life cell performance, and teardown analyses are discussed. These teardown analyses included visual observations, measurements of nickel electrode capacity in an electrolyte-flooded cell, dimensional changes of cell components, SEM studies on cell cross section, BET surface area and pore volume distribution in cycled nickel electrodes, and chemical analyses. Cycle life of a nickel-hydrogen cell was improved tremendously as KOH concentration was decreased from 36 to 31 percent and from 31 to 26 percent while effect of further concentration decrease was complicated as described in our earlier report. Failure mode of high concentration (31 to 36 percent) cells was gradual capacity decrease, while that of low concentration (21 to 26 percent) cells was mainly formation of a soft short. Long cycled (25,000 to 40,000 cycles) nickel electrodes were expanded more than 50 percent of the initial value, but no correlation was found between this expansion and measured capacity. All electrodes cycled in low concentration (21 to 26 percent) cells had higher capacity than those cycled in high concentration (31 to 36 percent) cells.

559 (N–89-22982, pp. 33) **Multi-mission Ni-H2 battery cell for the 1990's.** Miller, L.; Brill, J.; Dodson, G. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

A sufficient production, test and operational database is now available to permit design technology optimization for the next decade. The evolved battery cell design features standardized technology intended to support multiple type missions (e.g., both GEO and LEO). Design analyses and validation test cells demonstrate improved performance plus attractive specific-energy characteristics will be achieved.

560 (N–89-22982, pp. 35) **Hydrogen embrittlement in nickel-hydrogen cells.** Gross, S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

It was long known that many strong metals can become weakened and brittle as the result of the accumulation of hydrogen within the metal. When the metal is stretched, it does not show normal ductile properties, but fractures prematurely. This problem can occur as the result of a hydrogen evolution reaction such as corrosion or electroplating, or due to hydrogen in the environment at the metal surface. High strength alloys such as steels are especially susceptible to hydrogen embrittlement. Nickel-hydrogen cells commonly use Inconel 718 alloy for the pressure container, and this also is susceptible to hydrogen embrittlement. Metals differ in their susceptibility to embrittlement. Hydrogen embrittlement in nickel-hydrogen cells is analyzed and the reasons why it may or may not occur are discussed. Although Inconel 718 can display hydrogen embrittlement, experience has not identified any problem with nickel-hydrogen cells. No hydrogen embrittlement problem is expected with the 718 alloy pressure container used in nickel-hydrogen cells.

561 (N–89-22982, pp. 36) **Sodium sulfur battery flight experiment definition study.** Chang, R.R. (Ford Aerospace and Communications Corp., Newport Beach, CA (USA)); Minck, R. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Sodium-sulfur batteries were identified as the most likely successor to nickel-hydrogen batteries for space applications. One

advantage of the Na/S battery system is that the usable specific energy is two to three times that of nickel-hydrogen batteries. This represents a significant launch cost savings or increased payload mass capabilities. Sodium-sulfur batteries support NASA OAST's proposed Civil Space Technology Initiative goal of a factor of two improvement in spacecraft power system performance, as well as the proposed Spacecraft 2000 initiative. The sodium-sulfur battery operates at between 300 and 400 C, using liquid sodium and sulfur/polysulfide electrodes and solid ceramic electrolyte. The transport of the electrode materials to the surface of the electrolyte is through wicking/capillary forces. These critical transport functions must be demonstrated under actual microgravity conditions before sodium-sulfur batteries can be confidently utilized in space. Ford Aerospace Corporation, under contract to NASA Lewis Research Center, is currently working on the sodium-sulfur battery space flight experiment definition study. The objective is to design the experiment that will demonstrate operation of the sodium-sulfur battery/cell in the space environment with particular emphasis on evaluation of microgravity effects. Experimental payload definitions were completed and preliminary designs of the experiment were defined.

562 (N–89-22982, pp. 37-38) **Advanced high-temperature batteries.** Nelson, P.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The promise of very high specific energy and power was not yet achieved for practical battery systems. Some recent approaches are discussed for new approaches to achieving high performance for lithium/DeS2 cells and sodium/metal chloride cells. The main problems for the development of successful LiAl/FeS2 cells were the instability of the FeS2 electrode, which has resulted in rapidly declining capacity, the lack of an internal mechanism for accommodating overcharge of a cell, thus requiring the use of external charge control on each individual cell, and the lack of a suitable current collector for the positive electrode other than expensive molybdenum sheet material. Much progress was made in solving the first two problems. Reduction of the operating temperatures to 400 C by a change in electrolyte composition has increased the expected life to 1000 cycles. Also, a lithium shuttle mechanism was demonstrated for selected electrode compositions that permits sufficient overcharge tolerance to adjust for the normally expected cell-to-cell deviation in coulombic efficiency. Sodium/sulfur batteries and sodium/metal chloride batteries have demonstrated good reliability and long cycle life. For applications where very high power is desired, new electrolyte coinfigurations would be required. Design work was carried out for the sodium/metal chloride battery that demonstrates the feasibility of achieving high specific energy and high power for large battery cells having thin-walled high-surface area electrolytes.

563 (N–89-22982, pp. 39) **Advances in ambient temperature secondary lithium cells.** Subbarao, S.; Shen, D.H.; Deligiannis, F.; Huang, C.K.; Halpert, G. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The Jet Propulsion Laboratory is involved in a Research and Development program sponsored by NASA/OAST on the development of ambient temperature secondary lithium cells for future space applications. Some of the projected applications are planetary spacecraft, planetary rovers, and astronaut equipment. The main objective is to develop secondary lithium cells with greater than 100 Wh/kg specific energy while delivering 1000 cycles at 50 percent Depth of Discharge (DOD). To realize these ambitious goals, the work was initially focused on several important basic issues related to the cell chemistry, selection of cathode materials and electrolytes, and component development. The performance potential of Li-TiS2, Li-MoS3, Li-V6O13 and Li-NbSe3 electrochemical systems was examined. Among these four, the Li-TiS2 system was found to be the most promising system in terms of realizable specific energy and cycle life. Some of the major advancements made so far in the development of Li-TiS2 cells are in the areas of cathode processing technology, mixed solvent electrolytes, and cell assembly. Methods were developed for the fabrication of large size high performance TiS2 cathodes. Among the various electrolytes examined, 1.5M LiAsF6/EC + 2-MeTHF mixed solvent electrolyte was found to be more stable towards lithium. Experimental cells activated with this electrolyte exhibited more than 300 cycles at 100 percent Depth of Discharge. Work is in progress in other areas such as selection of lithium alloys as candidate anode materials, optimization of cell design, and development of 5 Ah cells. The advances made at the Jet Propulsion Laboratory on the development of secondary lithium cells are summarized.

564 **International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings.** 874p. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The present conference discusses Li rechargeable batteries, oxyhalide nonrechargeable batteries, reserve and thermal batteries, nonrechargeable thermal batteries, aqueous rechargeable and nonrechargeable batteries, advanced rechargeable batteries, high power/pulse power ambient temperature batteries, Li nonrechargeable batteries, fuel cells, and power generation/conditioning/charging technologies. Attention is given to the layer-formation of Li and its implications for secondary Li batteries, spirally wound Li-TiS2 cells, the electrochemistry of C relative to batteries and fuel cells, glass-seal corrosion in Li-SOCl2 batteries, a lithium-thionyl chloride battery for missile applications, low temperature thermal battery electrolytes, Al-air batteries, ovonic Ni/metal hydride batteries, Na/S cells, ultracapacitor filtering characteristics, long-life 'coin' cells, AgO cathode decomposition, and monolithic fuel-cell designs.

565 **Effects of the organic electrolyte solution on rechargeability of Li electrode.** Matsuda, Yoshiharu; Aoki, Seiki; Morita, Masayuki. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Mixed systems consisting of high permittivity solvents and low viscosity ethers are presently examined with a view to the influence of electrolyte composition on the charge-discharge behavior of Li. The chemical and electrical structures of the Li/electrolyte boundaries were investigated by means of an ac-impedance technique. The relationship between Li-rechargeability and electrolyte component properties is discussed. Electrolytes in which the structure of the Li/electrolyte interphase barely changes during the charge/discharge (i.e., deposition/dissolution) cycle yield high cycling efficiencies. 12 refs.

566 **Layer formation of lithium and its implications for secondary Li-batteries.** Wohlfahrt-Mehrens, M.; Schreck, B.; Schily, U.; Heitbaum, J. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

On-line mass spectrometry has been conducted during Li deposition on Ni out of propylene carbonate (PC)-LiClO4, followed by quartz microbalance and XPS measurements of freshly cut, in situ Li samples. During consecutive cycles, Li deposition and dissolution becomes progressively more irreversible; this may be attributable to polymer film growth, and could be the reason for the poor cycling efficiency of the lithium electrode in a secondary battery employing a PC electrolyte. The existence of an underlying Li2O layer reported in the literature is confirmed. 11 refs.

567 **Evaluation of mixed solvent electrolytes for ambient temperature secondary lithium cells.** Shen, D.H.; Subbarao, S.; Deligiannis, F.; Dawson, S.; Halpert, G. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ

(US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The ethylene carbonate/2-methyltetrahydrofuran (EC/2-MeTHF) mixed-solvent electrolyte has been experimentally found to possess many desirable electrolyte characteristics for ambient-temperature secondary Li-TiS2 cell applications. As many as 300 cycles have been demonstrated, and a cycling efficiency figure-of-merit of 38.5 percent, for 10-percent EC/90-percent MeTHF mixed-solvent electrolyte in experimental Li-TiS2 cells. The improved performance of this electrolyte is attributable to the formation of a beneficial passivating film on the Li electrode by interaction with the EC. 6 refs.

568 **Physicochemical factors influencing LiAsF6 reactivity.** Dominey, L.A.; Nanjundiah, C.; Koch, V.R. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Cyclic voltamogram data have been collected for LiTaF6 in purified sulfolane, both at room temperature and 70 C. At room temperature, the electrochemical behavior is found to be most similar to AsF6(-) out of all the XF6(-) anions studied to date; the anion is much larger than both AsF6(-) and SbF6(-), while the Lewis acidity of TaF5 appears to be closer to that of AsF5 than SbF5 or PF5. In order to avoid passivation effects and explore the electrochemical domain below 1 V, attention has been given to the results of dropping Hg electrode studies of LiSbF6, LiAsF6, and LiPF6.

569 **Lithium rechargeable cells using inorganic electrolytes.** Chang, O.K.; Hall, J.C.; Phillips, J.; Silvester, L.F. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

A lithium copper chloride inorganic electrolyte cell system has been developed which constitutes an important advancement in the safety of sulfur dioxide-based systems, in that the cell is not subject to random shorting and venting during cycling. A major performance-improvement factor is simultaneously obtained through the use of a microporous, polyethylene-tetrafluoroethylene copolymer separator that does not degrade the cell, while functioning as a good dendrite inhibitor. The system exhibits exceptionally high tolerance to overcharging and overdischarging, thereby allowing multicell packs to behave in a way similar to single cells.

570 **Lithium aluminum sulfur dioxide rechargeable system.** Harkness, A.C.; De La franier, C.; Brule, M. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

An account is given to the results obtained by an LiAl/SO2 rechargeable battery development effort whose primary goal was to create small, hermetically-sealed cells and demonstrate such a system's cyclability. The LiAl/SO2 system attempts to combine the best features of a Li alloy anode and a liquid cathode, with advantages in terms of both performance and safety; the discharge-curve is flat, and good performance retention is obtained at low temperatures. The melting point of the anode is of the order of 600-700 C, rendering the system inherently safer than pure Li, with its 180 C melting point. The lower reactivity of the alloy is likely to improve electrolyte stability. 18 refs.

571 **Rechargeable Li-TIS2 cells of spirally wound design.** Anderman, M.; Lundquist, J.T.; Johnson, S.L. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

A rechargeable battery employing a TiS2 cathode bound together by means of a polymer has been developed. This cathode material allows thin electrodes to be fabricated which are flexible and uniform, most notably in the case of a spirally-wound configuration having exceptionally high surface area. Performance characteristics of high energy density, moderately high cycle rate capabilities, moderate cycle life, and good charge retention, are obtained by this cathode design. Storage tests have also demonstrated excellent shelf life. 7 refs.

572 **Electrochemical behavior of niobium triselenide cathode in lithium secondary cells.** Ratnakumar, B.V.; Di Stefano, S.; Bankston, C.P. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Niobium triselenide cathodes in Li ambient-temperature rechargeable batteries for space applications undergo a topotactic reaction, with three equivalents of Li at high positive potential furnishing high energy density. It also yields good electronic conductivity, a long life cycle, and high diffusivity for Li. An attempt is presently made to characterize the intercalation mechanism between Li and NbSe3 by means of an ac impedance study conducted at various charge stages in the process of SbSe3 reduction. An effort is also made to predict the charge state of NbSe3 nondestructively, on the basis of the impedance parameters. 5 refs.

573 **High energy density lithium niobium triselenide cells.** Vyas, B. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

NbSe3 is a fibrous material that can intercalate three moles of Li/mole of itself; this insertion and removal of Li has been shown to be highly reversible. The material possesses metallic conductivity, and its fibrous morphology can be made similar to that of velcro; binders and conduction-enhancing additives are therefore obviated. The fibrous structure also furnishes a large effective surface area and easy electrolyte access, resulting in a high discharge-rate capability. NbSe3's middischarge voltage, which is in the vicinity of 2 V, in conjunction with its energy density, render NbSe3 a practical cathode materials. Attention is given to the performance of cylindrical, AA-type Li/NbSe3 cells. 7 refs.

574 **Reserve lithium-thionyl chloride battery for missile applications.** Planchat, J.P.; Descroix, J.P.; Sarre, G. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

A comparative performance study has been conducted for silver-zinc, thionyl chloride, and thermal batteries designed for such missile applications as ICBM guidance system power supplies. Attention is given to each of the three candidates' conformity to requirements concerning mechanical configuration, electrochemical design, electrolyte reservoir, external case, and gas generator. The silver-zinc and Li-SOCl2 candidates employ similar cell configurations and yield comparable performance. The thermal battery is found to be incapable of meeting battery case temperature-related requirements.

575 **Heat-transfer optimization of a high-spin thermal battery.** Krieger, F.C. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Recent advancements in thermal battery technology have produced batteries incorporating a fusible material heat reservoir for operating temperature control that operate reliably under the high spin rates often encountered in ordnance applications. Attention is presently given to the heat-transfer optimization of a high-spin thermal battery employing a nonfusible steel heat reservoir, on the basis of a computer code that simulated the effect of an actual fusible material heat reservoir on battery performance. Both heat paper and heat pellet employing thermal battery configurations were considered.

576 **Investigation of alternate electrolytes for thermal batteries.** Embrey, J.; Staniewicz, R.J. pp. 874 of International Power

Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

A single-cell testing of the KBr electrolyte vs the standard binary electrolyte has demonstrated the advantage for the lower melting-point electrolyte at current densities lower than 2 A/sq in. The KBr electrolyte is found to outperform the binary electrolyte at the lower operating temperature of 400 C. Initial battery tests with the substituted KBr electrolyte indicated a 30-percent improvement in service life; a broader operating temperature range of the KBr electrolyte could explain the extended battery life observed at 2.4 A/sq in. 7 refs.

577 **Evaluation of alternate electrolytes for use in Li(Si)/FeS2 thermal batteries.** Guidotti, R.A.; Reinhardt, F.W. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The optimum MgO contents for electrolyte-binder (EB) mixes based on low-melting electrolytes for Li(Si)/FeS2 batteries are established to be 30 percent for the CsBr-LiBr-Kbr and KBr-LiBr-LiCl (KLL) eutectics and 25 percent for the LiBr-KBr-LiF (LKL) eutectic. The optimum EB compositions of EBs formulated for the KLL and LKL electrolytes exhibit performance superior to those of EBs based on LiCl-KCl in the case of ramp-cooled single cells. The LiBr-LiCl-LiF 'all-Li' eutectic is far superior to the LiCl-KCl for high-current applications.

578 **Short circuit detection and active/passive transitions in nickel hydrogen cells.** Donley, S.; Matsumoto, J.; Zimmerman, A.H. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Passivation reactions at the Ni sinter surfaces in the 0.1-0.4 V range appear to limit the self-discharge rate in Ni-H cells at operating voltages. The oxides/hydroxides on the Ni sinter surfaces can be reduced to metals, and the metals reoxidized back to the oxides/hydroxides, at voltages below about 0.3-0.4. Measurements of the steady-state current needed to hold a discharged Ni-H cell at 0.8-1.8 V are noted to furnish a straightforward screening test for the detection of internal cell short-circuits or excessive self-discharge rates; measurements of the I/V curve for the cell in the 0-1.1 V range allow the effects of short circuits to be differentiated from those of high self-discharge rates.

579 **Performance of lightweight nickel electrodes.** Britton, D.L. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The NASA Lewis Research Center is currently developing nickel electrodes for nickel-hydrogen (Ni-H2) batteries. These electrodes are lighter in weight and have higher energy densities than the heavier state-of-the-art (SOA) sintered nickel electrodes. In the present approach, lightweight materials or plaques are used as conductive supports for the nickel hydroxide active material. These plaques (fiber and felt, nickel plated plastic and graphite) are commercial products that are fabricated into nickel electrodes by electrochemically impregnating them with active material. Evaluation is performed in half cells structured in the bipolar configuration. Initial performance tests include capacity measurements at five discharge levels, C/2, 1.0C, 1.37C, 2.0C and 2.74C. The electrodes that pass the initial tests are life cycle tested in a low earth orbit regime at 80 percent depth of discharge. Different formulations of nickel fiber materials obtained from several manufacturers are currently being tested as possible candidates for nickel electrodes. One particular lightweight fiber mat electrode has accumulated over 3000 cycles to date, with stable capacity and voltage. Life and performance data of this electrode were investigated and presented. Good dimensional stability and active material adherence have been demonstrated in electrodes made from this lightweight plaque. 7 refs.

580 **Conventional and foam nickel electrodes in the stabilized high energy nickel-zinc battery system.** Reisner, D.; Eisenberg, M. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The capabilities of a novel, foam-type nickel oxide cathode are presently compared with those of conventional, carbonyl nickel sintered plates. The open-pore characteristics of the foam matrix allow volumetric capacity densities of the order of 6.4 A-hr/cu in, representing 82 percent utilization, to be achieved; this compares with the 5.5 A-hr/cu in that it has been typical of conventional plates. Comparative results are presented as functions of plate porosity and mix composition in nickel-zinc cells incorporating the stabilized electrolyte system. 5 refs.

581 **Small scale bipolar nickel-hydrogen testing.** Manzo, M.A. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Bipolar nickel-hydrogen batteries, ranging in capacity from 6 to 40 A-hr, have been tested at the NASA Lewis Research Center over the past six years. Small scale tests of 1 A-hr nickel-hydrogen stacks have been initiated as a means of screening design and component variations for bipolar nickel-hydrogen cells and batteries. Four small-scale batteries have been built and tested. Characterization and limited cycle testing were performed to establish the validity of test results in the scaled down hardware. The results show characterization test results to be valid. LEO test results in the small scale hardware have limited value.

582 **Improved nickel electrodes for high temperatures.** Bugnet, B.; Rouget, R.; Doniat, D. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Results are presented on new nickel electrodes made by electrochemical impregnation of light-weight nickel felt fibers. Three types of nickel fiber electrodes were evaluated, including nickel felt without additives, nickel felt with cobalt, and nickel felt with cobalt plus cadmium additives. The electrodes were charged for 6 h at room temperature and left in 7.2 M KOH for up to three months. Discharge was carried out at room temperature. It was found that an addition of Co increased electrode capacity but did not affect the decay of capacity, while the combined addition of Co and Cd reduced the loss of capacity at 60 C. The results of tests of batteries manufactured with optimized electrodes are presented, confirming the results obtained in half-cell tests. 7 refs.

583 **Sodium sulfur cell design considerations for power applications.** Koenig, A.A. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The sodium sulfur cell and battery design considerations specific to power applications are analyzed. It is shown that a major design consideration for power is heat dissipation. The effect of a higher cell operating temperature on electrical and thermal performance is positive in all respects except corrosion. A 10-Ah central sodium cylindrical cell design is described which offers a specific power and energy of 225 W/kg and 125 Wh/kg at a 35-min rate. Cell life beyond 1300 cycles required for satellite missions will depend on the development of corrosion-resistant coatings and stringent and persistent process control. Battery thermal management schemes are offered to support the viability of a hp sodium sulfur battery.

584 **Life cycle testing of sodium/sulfur satellite battery cells.** Flake, R.A. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings.

Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Test results on sodium sulfur cells developed presently by the Air Force for NaS rechargeable batteries for baseload power applications are summarized. Cycle life data are presented on fourteen cells, some of which have accumulated more than 1900 days on test and/or more than 6000 cycles. Results demonstrated cycle life times to be sufficient for use on satellites in high-altitude orbits.

585 **Development of sodium-sulfur batteries for space power applications.** Wolanczyk, S.M. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The primary goal in the development of batteries for space power applications is the reduction in the weight and volume of the battery, as well as an increase in its lifetime. Efforts to pursue these goals resulted in programs designed to develop sodium-sulfur systems. One of these programs, initiated in 1986, is a battery design and development program, which is expected to deliver four 28-volt 0.5-kW batteries suitable for flight test and two 100-volt 2-kW modules for testing and evaluation. The second program is for the design of a NaS cell capable of achieving 50-Wh/lb in LEO. To meet the stringent requirements for beyond the year 2000, energy density goals will be a 100 Wh/lb battery.

586 **The development of a new sealed bipolar lead-acid battery.** Attia, A.I.; Rowlette, J.J. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

New light weight composite bipolar plates which can withstand the corrosive environment of the lead acid battery have made possible the construction of a sealed bipolar lead acid battery that promises to achieve very high specific power levels and substantially higher energy densities than conventional lead acid batteries. Performance projections based on preliminary experimental results show that the peak specific power of the battery can be as high as 90 kW/kg, and that a specific power of 5 kW/kg can be sustained over several thousand pulses. 5 refs.

587 **Low-temperature performance of a power-pack for a 2-watt ELT.** Walsh, F.; Fuksa, R. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The performance characteristics of two power packs for an airborne emergency locator transmitter (ELT) are described. One of these power packs is based on the use of 12 C-size alkaline cells; the other, on the use of four Li/SOCl2 cells. The performance under load of the two power packs was tested as a function of operating temperature. In these tests, the ELT with power pack was held in a cold chamber at the desired temperature for 24 h or longer prior to turning on the ELT; at this point, the load voltage across both the continuous drain and the pulse load circuits was monitored. It was found that, at temperatures lower than -10 C, only the Li/SOCl2-based power pack was capable of meeting both the desired discharge lifetime and power output requirements.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 45

2901 Energy Analysis and Modeling

Refer also to citation(s) 638, 1255

588 (CONF-8910162–4) **How far can the world get on energy efficiency alone?.** Katzman, M.T. Oak Ridge National Lab., TN (USA). 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 11. annual North American conference of the International Association for Energy Economists; Los Angeles, CA (USA); 16-18 Oct 1989. Order Number DE90001349. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A recent analysis suggests that by pursuing a path of energy efficiency, the industrial world can maintain and the developing world can achieve a high standard of living with little increase in primary energy consumption over the next 50 years. Moreover, this scenario can be achieved with a reduction of fossil fuel consumption. This paper is a synthesis of three basic issues discussed at a workshop recently held at ORNL to discuss the thesis. First, is this thesis plausible; to what extent can the scenario be achieved with currently or nearly available technology? Second, why can't a better job be done in reaching the potential; what are the barriers to the deeper penetration of energy-efficient technologies? Third, what policy and technological strategies are necessary to fulfill this scenario?

589 (DOE/EIA–M036) **PC-AEO forecasting model for the Annual Energy Outlook 1989: Model documentation.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. Mar 1989. 317p. Sponsored by U.S. DOE Management & Administration. Order Number DE90001699. Available from NTIS, PC A14/MF A01 - GPO - OSTI.

The objective of the PC-AEO modelling system is to make forecasts of national energy trends by fuel and sector for the Annual Energy Outlook published each year by the Energy Information Administration (EIA). The model was built with the aim of representing the most significant national characteristics of US energy markets, but entirely within the operating capability of a large personal computer, typically a fast "386" type of machine. 1 fig., 11 tabs.

590 (DOE/IR/05106–T52, pp. 5, Paper 1) **Community and economic development.** Laska, A. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Managing the impact of energy costs upon residential and commercial customers and enhancing local economic development through incentives, information exchange and technology demonstrations is addressed. Status of major projects at Chicago, New York, San Francisco, Houston, New Orleans is discussed.

591 (EPRI-CU–6457) **Evaluation of microcomputer programs for commercial building energy analysis: Final report.** Merriam, R. Electric Power Research Inst., Palo Alto, CA (USA); Little (Arthur D.), Inc., Cambridge, MA (USA). c Oct 1989. 103p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Available microcomputer commercial building energy analysis programs are assessed from an electric utility perspective. A total of 11 programs applicable to commercial building energy analysis that use hourly dynamic load calculations are identified. They are characterized in five major categories: basic features, availability, data input methods, analysis capabilities, and output features. Two programs, ADM-2 and Micro-AXCESS, were selected for testing and further evaluation. Two test buildings were defined: a three-story office building with multiple heating and cooling distribution systems, and a one-story office building using a single variable air volume system. Both models were found to give similar annual energy consumption estimates as the DOE 2.1 and BLAST mainframe computer programs. The particular strengths and weaknesses of the two programs are identified. Specific recommendations for program improvements and for use of these programs are made. 21 refs., 4 figs., 25 tabs.

592 (EPRI-P–6552) **Why issues emerge: Final report.** Coates, J.F.; Jarrett, J.; Decker, C. Electric Power Research Inst., Palo Alto, CA (USA); Coates (J.F.), Inc., Washington, DC (USA). c Oct 1989. 180p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

For those analysts and managers responsible for anticipating issues that may become important to their organizations, the origin of such issues is an important question. This study looks at how, and why, an issue may emerge from a situation, or an event. The full development of an issue, and its resolution may take from five to 30

years or more. The earlier it can be anticipated, the more opportunity for its stakeholders to develop positions and options for addressing it. Three approaches to examining the origins of issues are employed; the invention of ten models as metaphors for the formation and growth of issues; the test of these models against 12 well-known, and fully developed issues; and the analysis of three case studies of issue development. This analysis assesses the readiness at different times for cultural, institutional and situational factors to allow or promote a situation to transition into an issue. Six of the ten conceptual models prove to be more powerful metaphors of issue development than the others. Analysis of the case studies shows that a readiness assessment of an unfolding situation may yield clues to a new issue. A readiness checklist is provided. 6 figs., 4 tabs.

2902 Economics and Sociology

Refer also to citation(s) 72, 74, 94, 95, 97, 143, 590, 620, 635, 637, 638, 639, 640, 641, 642, 643, 644, 645, 651

593 (DOE/IR/05106–T52, pp. 4, Paper 3) **Energy and waste management.** Demos, E.K. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Various household waste management methods are investigated to determine options for implementation of plans for discarding, safely collecting, recycling or re-using hazardous household wastes; also to examine potential by-products of hazardous waste and possible waste-to-energy production applications by municipalities. The status is reported for studies being conducted in Seattle, Hennepin County, Albuquerque, Baltimore and Detroit.

594 (DOE/IR/05106–T52, pp. 35, Paper 4) **Community and economic development.** Laska, A. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Managing the impact of energy costs upon residential and commercial customers and enhancing local economic development through incentives, information exchange and technology demonstrations is being investigated. The city role in promoting a site-specific competitive energy market will consider supply options, while demand in the commercial sector will address incentives to stimulate large-scale lighting retrofit and a matching of energy cost-sensitive businesses with efficient new buildings to house them. Technologies will be tested in retrofit of mass single family housing with the potential of linkage in a district system. Computer-based Human Services on Cable project will provide energy resources and assistance to the general public. Small business energy assistance programs will be assessed through a survey of municipalities, utilities, states and other sponsors. A status report is provided for projects at Chicago, New York city, San Francisco, Houston, and New Orleans.

595 (DOE/IR/05106–T52, pp. 4, Paper 5) **Renewable energy unit (Year 10).** Laska, A.L. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Research, development and increasing use of renewable energy resources is considered essential. Renewable energy resources include recurring alternate supplies (solar, biomass, wind) as well as techniques to reduce demand for conventional now-renewable energy resources. Emphasis is needed on the synthesis of energy concerns with broader local interest in economic development and environmental quality to develop sustainable urban areas. Global policy issues and practices of urban jurisdictions are addressed. One project experiments with heating system innovations in the interest of economy, energy savings and public health and safety. Status is reported for participating cities which include; San Jose, Portland, San Francisco, New Orleans, and the Washington State Energy Office.

596 (DOE/IR/05106–T52, pp. 6, Paper 6) **Alternate vehicle fuels unit.** Whittenberg, P.L.; Sullivan, R. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Seven applied research projects and one transfer project in process are reported for the following jurisdictions; Alternative Fuel Vehicles in Municipal duty cycles at Albuquerque; Dual-fuel conversion at Broward County, FL; Northern Illinois clean fuel consortium at Chicago; Mitigating air quality impacts at the new Denver airport; Fleet assessment for opportunities to deploy light duty vehicles in Detroit; compressed natural gas usage at Pittsburgh. Infrastructure issues at New York; Analysis of programmatic fleet conversion to ethanol blends at Phoenix.

597 (DOE/IR/05106–T52, pp. 5, Paper 7) **Alternative vehicle fuels unit.** Whittenburg, P. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

The comparative benefits of compressed natural gas, oxygenated fuels and gasoline as primary fuels for municipal vehicles is examined at Albuquerque, NM.

598 (DOE/IR/05106–T52, pp. 4, Paper 8) **Alternate vehicular fuels.** Whittenburg, P.L. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

The comparative benefits of dual fueled vehicles with compressed natural gas and gasoline as primary fuels for municipal vehicles in public works is examined at Broward County, Florida.

599 (DOE/IR/05106–T52, pp. 28, Paper 9) **Alternate vehicle fuels unit.** Whittenburg, P.L. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Alternative fuels as well as certain components of urban design as air pollution mitigation strategies within the context of the new Denver airport are examined. Research focus is on the determination of emissions, cost, operational, and other requirements essential in an airport environment. The urban design component will focus on formulating a guide that will highlight interrelationships among land use, transportation and air quality policy goals and related terminal design changes.

600 (DOE/IR/05106–T52, pp. 5, Paper 11) **Alternative vehicle fuels.** Whittenberg, P. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Realistic use of alternative vehicles will require the alternate fuel industry and vehicle manufacturers to develop the infrastructure for fuel production, distribution, and vehicles to support the introduction of alternative vehicles. Infrastructure development presents a number of issues for auto makers, fuel producers, and federal, state and local governments. This project will provide a comprehensive analysis of the economics of alternative systems and a framework for analyzing the associated risks and rewards. Options will be assessed for construction of methanol and natural gas fueling stations in New York City, and the costs and benefits of public versus private ownership of facilities for municipal fleet vehicles.

601 (DOE/IR/05106–T52, pp. 4, Paper 13) **Analysis of programmatic fleet conversion to ethanol blends technology transfer project.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

The project status is reported. The use of a ten percent ethanol blend with unleaded gasoline as an alternative fuel for vehicles used in the operation of a major city is being evaluated at Phoenix. The project tests for cost, drive ability, maintenance, and emissions. The objective is to improve air quality in major cities. Technology transfer is planned to benefit other jurisdictions

602 (DOE/IR/05106–T52, pp. 5, Paper 14) **Energy and waste management.** Demos, E.K. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Various household waste management methods are investigated to determine options for implementation of plans for discarding, safely collecting, recycling or re-using hazardous household wastes; also to examine potential by-products of hazardous waste and possible waste-to-energy production applications by municipalities. Status is reported for studies being conducted in Seattle, Hennepin County, Albuquerque, Baltimore and Detroit.

603 (DOE/IR/05106–T52, pp. 19, Paper 17) **Renewables.** Laska, A. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

The project examines how the use of renewable energy resources and the efficient use of energy can contribute to achievement of broad community goals. A strategic planning process is used to define needs, actions, costs and resources to integrate local planning into broad policy and decision-making framework for an urban community. The status is reported for the city of San Jose, city and county of San Francisco, and New Orleans.

604 (PB–89-217608/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington). Volume 1 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 177p. Available from NTIS, PC A09/MF A01.

See also Volume 2, PB–89-217616; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Washington Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Washington Area includes Jefferson, Clallam, Island, San Juan, Grays Harbor, Pacific, and Wahkiakum counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

605 (PB–89-217616/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington). Volume 2 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 267p. Available from NTIS, PC A12/MF A01.

See also Volume 1, PB–89-217608 and Volume 3, PB–89-217624; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Washington Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Washington Area includes Jefferson, Clallam, Island, San Juan, Grays Harbor, Pacific, and Wahkiakum counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

606 (PB–89-217624/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington) Volume 3 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 256p. Available from NTIS, PC A12/MF A01.

See also Volume 2, PB–89-217616 and Volume 4, PB–89-217632; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Washington Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Washington Area includes Jefferson, Clallam, Island, San Juan, Grays Harbor, Pacific, and Wahkiakum counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

607 (PB–89-217632/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington) Volume 4 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 267p. Available from NTIS, PC A12/MF A01.

See also Volume 3, PB–89-217624; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Washington Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Washington Area includes Jefferson, Clallam, Island, San Juan, Grays Harbor, Pacific, and Wahkiakum counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

608 (PB–89-217640/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Oregon) Volume 1 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 169p. Available from NTIS, PC A08/MF A01.

See also Volume 2, PB–89-217657; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Oregon Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Oregon Area includes Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry counties. It presents baseline socio-economic profiles of coastal counties in Oregon, Washington, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socioeconomic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

609 (PB–89-217657/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 2 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 249p. Available from NTIS, PC A11/MF A01.

See also Volume 1, PB–89-217640 and Volume 3, PB–89-217665; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Oregon Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Oregon Area includes Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry counties. It presents baseline socio-economic profiles of coastal counties in Oregon, Washington, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

610 (PB–89-217665/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 3 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 259p. Available from NTIS, PC A12/MF A01.

See also Volume 2, PB–89-217657 and Volume 4, PB–89-217673; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Oregon Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Oregon Area includes Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry counties. It presents baseline socio-economic profiles of coastal counties in Oregon, Washington, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

611 (PB–89-217673/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon). Volume 4 of 4. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 264p. Available from NTIS, PC A12/MF A01.

See also Volume 3, PB–89-217665; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Coastal Oregon Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Coastal Oregon Area includes Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry counties. It presents baseline socio-economic profiles of coastal counties in Oregon, Washington, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

612 (PB–89-217681/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 313p. Available from NTIS, PC A14/MF A01.

See also Volume 2, Part 1, PB–89-217699; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Puget Sound Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Puget Sound Area includes Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Mason, and Kitsap counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

613 (PB–89-217699/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 312p. Available from NTIS, PC A14/MF A01.

See also Volume 1, Part 1, PB–89-217681; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Puget Sound Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Puget Sound Area includes Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Mason, and Kitsap counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

614 (PB–89-217707/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 293p. Available from NTIS, PC A13/MF A01.

See also Volume 2, Part 2, PB–89-217715; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Puget Sound Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Puget Sound Area includes Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Mason, and Kitsap counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

615 (PB–89-217715/XAB) **Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report.** Kearney (A.T.), Inc., Alexandria, VA (USA). Dec 1988. 274p. Available from NTIS, PC A12/MF A01.

See also Volume 1, Part 2, PB–89-217707; Also available in set of 12 reports PC E99, PB–89-217590.

This report presents socio-economic profiles of the counties in the Puget Sound Area of the Washington-Oregon Planning Area of the Minerals Management Service. The Puget Sound Area includes Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Mason, and Kitsap counties. It presents baseline socio-economic profiles of coastal counties in Washington, Oregon, and California which may be potentially affected by offshore oil and gas development. Each profile includes socio-economic characteristics organized under the following eight headings: demographics, economics, housing, public services and facilities, public finance, energy consumption, land use, and other characteristics. The focus of each socio-economic profile is 1980, but the time period 1970 to 2000 is covered, to the extent possible with existing data, to provide a historical context and an understanding of expected trends. Each county's socio-economic profile was prepared using time-series data from secondary sources obtained primarily from federal, state, and local government agencies.

2903 Environment, Health, and Safety

Refer also to citation(s) 39, 41, 42, 49, 69, 70, 73, 80, 81, 82, 83, 98, 182, 218, 219, 504, 599, 623, 625, 629, 642, 643, 717, 719, 722, 733, 738, 740, 748, 1277, 1278, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1299, 1300, 1321, 1328, 1329, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1361, 1465

616 (CONF-8910235–1) **Environmental boundaries to energy development.** Trivelpiece, A.W. Oak Ridge National Lab., TN (USA). [1989]. 49p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Joint U.S. National Academy of Sciences of the USSR seminar on global energy development and associated ecological (environmental) impacts in Moscow; Moscow (USSR); 17-20 Oct 1989. Order Number DE90001359. Available from NTIS, PC A03/MF A01 - OSTI.

Public concern about the environment, health and safety consequences of energy technology has been growing steadily for more than two decades in the United States. This concern forms an important boundary condition as the United States seeks to develop a new National Energy Strategy. Furthermore, the international aspects of the energy/environment interface such as acid rain global climate change and stratospheric ozone depletion are very prominent in US thinking. In fact, the energy systems of the world are becoming more closely coupled environmentally and otherwise. Now where is this coupling more important than that between the industrialized and developing world; the choices made by each will have profound effects on the other. The development of energy technologies compatible with both economic growth and improving and sustaining environmental quality represents a major R&D challenge to the US and USSR. Decision about adoption of new technology and R&D priorities can be improved by better measurements of how energy sources and uses are changing throughout the world and better methods to project the potential consequences of these decisions. Such projection require understanding relative risks of alternating existing and evolving technologies. All of these R&D areas, technology improvement energy system monitoring and projection and comparative risk assessment are the topics of this seminar. Progress in each may be enhanced by collaboration and cooperation between our two countries. 7 refs., 27 figs., 5 tabs.

617 (PB–89-205934/XAB) **Procedures for completion and deletion of National Priorities List sites.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Apr 1989. 44p. (EPA–540/G-89/002). Available from NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

This document focuses on the technical requirements that have been developed to determine the completion of cleanup at Superfund sites and the subsequent procedural requirements for deleting sites from the National Priorities List (NPL). The guidance does not apply to sites that are removed from the NPL so that action can be taken under a different authority or to proposed sites that do not get placed on the final NPL. Expected users of the document include EPA personnel, states, and responsible parties involved in completion of cleanup activities at Superfund sites. The roles and responsibilities of all parties are herein described.

618 (PB–89-211767/XAB) **Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report.** Nuckels, J.H. Virginia Univ., Charlottesville, VA (USA). Div. of Urban and Environmental Planning. 13 Apr 1989. 111p. Available from NTIS, PC A06/MF A01.

Under Title III, Section 313 of the Superfund Amendment and Reauthorization Act of 1986 (SARA) companies which release toxic chemicals into the environment are required to report annually the amount of these toxic releases. Because the chemical toxic-release reports are public information, EPA Region V is concerned that the raw data published in the toxic-chemical-release reports will be misinterpreted and will in turn generate unfounded public concern. The study examines the possibility of using the Graphical Exposure Modeling System (GEMS), a computer program, to transform incoming raw data into better qualified, user ready, public information. Specifically, the report analyzes the compatibility between the raw data reported in the toxic chemical release reports and the input requirements of the GEMS exposure model. An industrial site in East St. Louis, Illinois is used as a test site for the development of the exposure assessment. The study discusses the research and the methods used to perform the exposure assessment. The report also reviews the legislation which requires companies to report toxic-release data, the basics of exposure assessment and the GEMS model, the research methods used, and the findings of the study.

619 (PB–89-924700/XAB) **Hazardous Materiel Data File (HMDF), quarterly update. Data file.** Army Materiel Command, New Cumberland, PA (USA). Catalog Data Activity. 1 May 1989. mag ta Available from NTISCP T99.

Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Available on subscription, North American Continent price $840.00/year; individual issue $210.00; all others write for quote. Issued quarterly.

The Hazardous Materiel Data File's purpose is to provide storage and transportation information on chemical, radioactive, and ammunition items in the Army inventory. Data are taken from the Army Central Logistics Data Bank.

2904 Natural Resources

Refer also to citation(s) 646, 1365

620 (PB–89-196927/XAB) **Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials.** International Bank for Reconstruction and Development, Washington, DC (USA). 1989. 595p. Available from NTISMF A01.

Library of Congress catalog card no. 89-5529.

Contents include: Energy; Metals and Minerals; Food Products; Fertilizers and Agricultural Raw Materials.

621 (PB–89-209605/XAB) **United Kingdom Minerals Yearbook, 1988. Statistical data to 1987.** Fellows, M.E.; Highley, D.E.; Linley, K. British Geological Survey, Keyworth (UK). 1989. 89p. Available from NTIS, PC EE06/MF E06.

See also PB–88-220801.

Statistical data on the United Kingdom's minerals industry is presented along with commentary on current trends and developments in the industry. Discussed are: minerals in the UK economy, energy minerals, construction and industrial minerals, metals, and commodity summaries. Maps and diagrams are used throughout the report.

622 (PB–89-214217/XAB) **Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88.** Chatman, M.L. Bureau of Mines, Denver, CO (USA). Intermountain Field Operation Center. 31 Mar 1989. 75p. (BUMINES-OFR–15-89). Available from NTIS, PC A04/MF A01.

Color illustrations reproduced in black and white.

In 1987 and 1988, the Bureau of Mines evaluated pegmatites and granitic rocks on the south side of Copper Mountain, Fremont County, WY, primarily for the strategic metals tantalum, niobium, and beryllium. The U.S. relies on foreign imports for over 90% of the tantalum and niobium consumed annually, and has no major known tantalum deposit. Widely spaced reconnaissance sampling identified subeconomic tantalum resources in two pegmatites on Copper Mountain, amounting to 1.5 million short tons at grades of 0.02% to 0.03% Ta_2O_5 (tantalum pentoxide). Tantalum content is 0.8 million pounds of Ta_2O_5, or about 1/5 of the total tantalum resources delineated in the U.S. Tantalum recovery testing showed that 70% recovery is possible. Additionally, niobium and beryllium could be byproducts of tantalum mining. Tungsten, gold, silver, and copper, primarily in quartz veins, are not present in economic amounts. Sample assays suggest additional tantalum resources could be present in other pegmatites in the study area, but more sampling work is required to determine resources. Unsampled pegmatites on an adjacent 2 square miles of land should be examined. Discovery of more tantalum resources could help alleviate U.S. dependence on foreign imports.

623 (PB–89-214878/XAB) **Mt. Trumbull and Mt. Logan wilderness management plan. Draft report.** Bureau of Land Management, Phoenix, AZ (USA). Arizona State Office. 1989. 139p. (BLM/AZ/PT–89/009/8500). Available from NTIS, PC A07/MF A01.

Also available from Supt. of Docs.

The plan provides management guidance for the Mt. Trumbull and Mt. Logan Wildernesses. Because these two areas have very similar resource characteristics and management issues, they are being managed under one plan. Throughout the development of this plan, the Arizona Wilderness Act of 1984 and the Wilderness Act of 1964 are used to guide the development of objectives, policies and the kind, type and method of management actions needed to maintain or enhance the wilderness resources and values.

624 (PB–89-214928/XAB) **Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming.** Bove, D.J.; Carlson, R.R.; Kulik, D.M.; Lundby, W. Geological Survey, Alexandria, VA (USA). 1989. 26p. (LCCCN–88-607933). Available from NTIS, PC A03/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card No. 88-607933.

At the request of the U.S. Bureau of Land Management, 710 acres of the Owl Creek Wilderness Study Area were studied for mineral endowment. Field and labortory studies were conducted by the U.S. Geological Survey and the U.S. Bureau of Mines. A search of U.S. Bureau of Land Management, State, and county records showed no current or previous mining claim activity and, other than common-variety sand and gravel, no mineral resources were identified during field examination of the study area. Sand and gravel is classified as an inferred subeconomic resource; however, the remoteness of the area precludes much usage of the material. About two-thirds of the study area is under lease for oil and gas. The entire study area has moderate resource potential for undiscovered oil and gas and low resource potential for undiscovered metals, coal, zeolites, and geothermal energy.

625 (PB–89-217210/XAB) **Environmental management and economic development.** Schramm, G.; Warford, J.J. International Bank for Reconstruction and Development, Washington, DC (USA). 1989. 220p. Available from NTISMF E10.

Library of Congress catalog card no. 89-8001; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

Contents include: environmental management and economic policy in developing countries; environmental and natural resource accounting; marginal opportunity cost as a planning concept in natural resource management; the environmental basis of sustainable development; economic incentives for sustainable production; deforestation in Brazil's Amazon region: magnitude, rate, and causes; an economic justification for rural afforestation: the case of Ethiopia; managing the supply of and demand for fuelwood in Africa; economic aspects of afforestation and soil-conservation projects; multilevel resource analysis and management: the case of watersheds.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 1, 42, 44, 49, 109, 234, 594, 595, 596, 597, 598, 600, 601, 603, 638, 642, 646

626 (AD-A–210023/8/XAB) **Department of Energy Technology Annual Progress Report, 1 January-31 December 1988.** Michaelsen, B.; List, F. Risoe National Lab., Roskilde (Denmark). Mar 1989. 44p. (RISOE-R–567). Available from NTIS, PC A03/MF A01.

Contents include: new features in the Cosima boiling water reactor core simulator; flux calculations in a new horizontal irradiation facility in DR 3; implementation and modification of aerosol codes; the Temperature Calibration laboratory; fundamental combustion research; 2-MW circulating fluid-bed test facility; experimental investigation of pulverized coal burners; studies of laser methods; large-scale laboratory tests of two-phase flow phenomena; computer modelling of steady three-dimensional turbulent gas/particle flows; gasification of straw, literature review; oil recovery from fractured reservoirs and the temperature field around a hot magma sheet.

627 (DOE/IR/05106–T52, pp. 5, Paper 2) **Local Government Operations.** Whittenberg, P.L. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Status is reported for five applied research projects and one transfer project to improve energy use efficiency in municipal buildings and facilities, with attention to technology, procurement practices and training. Research projects are in process at Memphis, Kansas City, Montgomery County MD, San Jose, and Phoenix. Traffic management is studied at Memphis.

628 (DOE/IR/05106–T52, pp. 3, Paper 10) **Local Government Operation.** Whittenberg, P. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Detroit is conducting a two phase research program to assess the potential for substitution of current vehicles with alternative fuel vehicles. The first phase involves a survey of potential departments and organizations operating light trucks or vans. The second phase will evaluate the General Motors Griffon electric van in a mini-demonstration phase at seven sites for a period of four weeks at each site. Drivers and supervisors will be interviewed to obtain impressions and attitudes.

629 (DOE/IR/05106–T52, pp. 4, Paper 16) **Waste-to-energy.** Miller, R.D. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force status report for first quarter year ten.* Order Number DE89014845. Available from NTIS, PC A08/MF A01.

Improving the effectiveness of waste management is one of the most crucial challenges facing urban governments today. Solutions are needed to capture the waste materials potential as renewable energy resources. The project emphasis is placed on specific applications and technologies, well designed methods for cost and risk management, and improved means to generate institutional and public support for implementation. The status is reported for participating jurisdictions in Hennepin County, MN, Memphis, TN, Montgomery County, MD, Seattle, WA, St. Louis, MO, and Philadelphia, PA.

630 (DOE/IR/05106–T52, pp. 5, Paper 18) **Electricity management.** Williams, C.H. Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. In *Energy Task Force*

status report for first quarter year ten. Order Number DE89014845. Available from NTIS, PC A08/MF A01.

High energy costs can place severe burdens on residents and constrain growth for both energy intensive industries and the small business sector. A stable, secure and reasonably priced supply of electric energy will require strategies which support decentralized power production, better demand management, and improved energy use efficiency. The status is reported for participating jurisdictions of Chicago, Columbus, Houston, Kansas City, New York, St. Louis, Albuquerque and Montgomery County, MD.

631 (UCRL–52000-89-9) **Energy and Technology Review, September 1989.** Burnham, A.K.; Corey, C.W.; de Vore, L.; Gleason, K.; Sanford, N.M.; Taft, S.O.; Van Dyke, P. (eds.). Lawrence Livermore National Lab., CA (USA). Sep 1989. 34p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001882. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Energy and Technology Review for September 1989 covers: ground- based laser defense systems, the High-Speed Microphotographic Facility, fusion gamma experiments, and DNA and protamine computer modeling and microscopy.

2906 Nuclear Energy

Refer also to citation(s) 49, 143, 158, 182, 218, 219, 350, 1912, 1974

632 **Nuclear power: A public policy issue.** Smith, E.T. *Transactions of the American Nuclear Society (USA),* 57: 205 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Today, the United States has an adequate supply of electrical energy. To maintain an adequate supply in the future, additional generating capacity will be required. In the present environment, one major source of electrical energy will not be a part of this additional capacity - nuclear power. Various areas are investigated for their impacts on the growth of nuclear power. The nuclear industry is taking appropriate actions to address the technical and economic issues it faces. So why is nuclear power growth nonexistent? A conclusion is reached that for the use of nuclear power to increase in the United States, the nuclear industry must first elevate the topic of energy to an issue of public policy and define nuclear power's role in implementing the policy rather than trying to sell nuclear power on its own. This is what has happened in other countries. To do this, the industry needs to elevate the debate both in the Congress and in the media that now is the time to take action on energy in this country before we have another energy crises. The failure to raise the issue of energy to a public policy level will result in the United States finding itself in a critical situation sometime in the future. The failure to actively participate and help direct the debate on energy, and nuclear in particular, will result in nuclear power providing a shrinking percentage of this country's energy supply.

2907 Transport and Storage

Refer also to citation(s) 38, 83

2910 Conservation

Refer also to citation(s) 588, 590, 630, 637, 638, 639, 640, 641, 642, 643, 644, 645, 680

633 (CONF-8808273–Vol.3) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 3, Commercial and industrial building technologies.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 230p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

Panel 3 addresses energy efficiency in the commercial building sector, focusing on: the commercial building design process; commercial sector data; commercial sector technology; and commercial building retrofits. Significant findings from the Summer Study are presented below for each topic. For more detail, please refer to the selected papers in this volume, to the volume of abstracts, or to the reprints of other Summer Study papers in the Proceedings.

634 (CONF-8808273–Vol.5) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 5, National and regional conservation programs.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 138p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

The papers encompassed in the National and Regional Conservation Programs Panel cover one of the broadest ranges of any panel at the Summer Study. Topics addressed span a spectrum from building codes to acid rain, and represent contributions from 7 different states, the federal government, several national research laboratories and two European nations. The papers address programs in many states and several nations. For the purposes of presentation, the papers have been grouped, based on general content area, into six different sessions. A brief description of the papers in each session is provided.

635 (CONF-8808273–Vol.11) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 11, Behavior and lifestyle.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 164p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

The panel on behavior and lifestyle continues to have some of the most challenging sessions at the conference due to the wide diversity of papers presented. In fact, this panel is one of the most difficult panels to delineate because its boundaries have no end. The behavior of individuals and organizations impacts all the panels at this year's conference: the effectiveness of energy conservation models, technologies, and programs depends on the behavior of people, either as sponsors or as users. Accordingly, readers of the papers in this panel are encouraged to review the papers in the other panels for learning more about the impact of behavior on energy conservation.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 27, 59, 91, 92, 589, 620, 637, 638, 639, 642, 643, 644, 645, 652

636 (DOE/EIA–0202(89)) **Short-term energy outlook: Annual supplement 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 31 Oct 1989. 71p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002593. Available from NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.

This Supplement is published once a year as a complement to the Short-Term Energy Outlook, Quarterly Projections (Outlook). The purpose is to review the accuracy of the forecasts presented in the Outlook, make comparisons with other independent energy forecasts, and examine current energy topics that affect the forecasts. A brief description of the content of each chapter follows below: Chapter 2 evaluates the accuracy of the short-term energy forecasts published in the last 6 issues of the Outlook, for 1988/1989. Chapter 3 discusses the economics of the petrochemical feedstock market, and describes a new model which more fully captures the determinants of feedstock demand. Chapter 4 examines present and proposed new methods of forecasting short-term natural gas prices at the wellhead and spot prices. Chapter 5 discusses the modeling of natural demand in the short term. Chapter 6 discusses regional trends in the demand for fuel by electric utilities. Chapter 7 focuses on industrial coal use trends in recent years. Chapter 8

compares EIA's base case energy projections as published in the Outlook (89/2Q) with recent projections made by three other major forecasting groups. The chapter focuses on macroeconomic assumptions, primary energy demand, and primary energy supply, showing the differences and similarities in the four forecasts.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 13, 27, 40, 41, 42, 43, 44, 69, 70, 71, 72, 74, 75, 76, 84, 85, 94, 95, 96, 97, 99, 108, 110, 143, 158, 258, 616, 747, 1255, 1299, 1300, 1328, 1329, 1361

637 (DOE/CH/10348–1, pp. 25-27) **Oil import taxes and national security.** Wallace, M. (Hughes and Luce, Austin, TX (USA)). Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

The use of an oil import tax is advocated to enhance national security. Oils strategic importance in the peace time economy and military mobilization is undisputed. The scope and degree of US reliance on imports and the increasing trend is not generally known by the average citizen. Three-fourths of the worlds oil is produced by governments and not oil companies. National leadership is expected to take the necessary steps to protect national security. Oil and gas resource bases are adequate for domestic production to supply a high enough percentage of US oil needs to prevent dangerous dependence on imports. A return to an investment climate with prices near the 1885 price levels will assure aggressive development of natural resources. The variety of arguments raised against an import tariff are considered baseless. A tariff structure need not be complex and a variable fee is supported. A 10-barrel-per-day well in the US produced from a free man's lease cannot compete with an 11,000 barrel-per-day Saudi well produced from a government lease with substandard labor.

638 (DOE/CH/10348–1, pp. 69-98) **Opportunities for conservation and alternative energy technologies.** Rosenfeld, A. (Lawrence Berkeley Lab., CA (USA)). Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

In the last 14 years, dramatic improvements have been made in energy efficiency. Conservation is discussed in general with most of the focus on buildings which account for 38% of the $440 billion annual US energy bill. A 33% increase in efficiency has been achieved and has produced an annual savings of $150 billion. Savings by sector amount to; buildings 50%, industry 30%, and transport 20%. Conservation has bought valuable time and a vigorous government/utility conservation program can continue the flat demand almost indefinitely, despite a reasonable growth in GNP. The US energy bill amounts to 11% of the GNP, while the Japanese spend only 5% of their GNP on energy. Least-cost calculations show that optimal investment would halve energy use by the turn of the century. Saving energy is three-to-five times cheaper than paying for wasted energy. Despite big payoffs, public R&D for energy conservation has declined compared to other economic sectors. Large industrial firms have been slow in promoting new and innovative technologies. Federal acceleration of R&D can reduce the time it takes for new energy-efficient technologies to appear on the market. US competitiveness needs major attention. For example, the present US manufacturer's share of the domestic power electronics market is expected to erode from its present level of 50% to about 25% within five years. If the present trend continues, the US will be a minor force in the world market for electronic materials and systems by the 1990s. Energy policies are suggested for redirecting efforts towards providing all energy services desired by the customer at low cost rather than providing all desired raw energy but at high cost.

639 (DOE/CH/10348–1, pp. 101-112) **Opportunities for industry to improve its competitive position.** Prendergast, J.T. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

Background information is given on LTV and its competition and cost experience. Problems resulted from a decline in business. Steel making is an energy-intensive business. As a group, the primary metals industries are third behind the chemicals and petroleum in industrial energy consumption. Consumption of fuel types by steel companies shows a predominant use of coal and coke at about 64%, natural gas 24%, electricity 7% and petroleum products at 5%. Critically important to integrated steel makers are the by-product gases generated from coke. Otherwise natural gas or oil would be purchased. Energy comprises 15-20% of total steel production costs. Natural gas and electricity make up 50% of LTV's energy costs. LTV's has focused on conservation, cost, and awareness and achieved a 25% reduction in energy input per ton of product shipped during 1980-86. An energy management reporting system is used to monitor the annual energy reduction goal of 3%. Lack of funds has generally restricted conservation project investments to those with one year pay back. Energy cost reductions have been achieved with new sources for natural gas and off-peak power use of electricity. Special efforts are made to keep representatives in state and federal governments informed of activities impacting on steel making competitiveness.

640 (DOE/CH/10348–1, pp. 113-118) **Third-party financing option.** Benda, G.J. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

Commercial and institutional energy consumers have grown quite savvy about energy economics during the past decade. Key aspects of their growing knowledge and skill in managing their energy costs include: (1) using regulations; and rate structures to reduce costs of utility supplied energy; (2) using free market mechanisms for purchase of oil and natural gas; (3) developing cogeneration and waste incineration facilities to reduce the total purchased energy; and (4) implementing comprehensive energy management programs. The technical and regulatory complexity of energy cost reduction actions by institutions has resulted in a net increase in their reliance on outside experts and service companies. In combination, the complexity and economics of energy programs has increased the attractiveness of third-party finance options for commercial and institutional energy consumers. The third-party finance industry has evolved into a small but growing energy services industry. Energy service companies offer hybrid engineering-general contractor-financing packages. Energy conservation projects are pursued on narrow economic lines to meet a short simple pay back financial criteria. At the same time the client's facility is hardened against economic or supply shocks from the energy market. The health care industry is used as a case in point due to the pressures for cost containment. Energy service companies, their investors, clients and the public in general will benefit from pursuing energy conservation projects with a real pay back.

641 (DOE/CH/10348–1, pp. 119-127) **Energy purchasing alternative: Chicago reviews its position.** Williams, C.H. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

The city of Chicago is in the process of evaluating all the electric supply options available when the current franchise held by Commonwealth Edison terminates in 1990. Reliable and adequate supplies of electric power are critical to overall commercial and industrial development. Uncompetitive pricing of electricity is a deterrent to new investment in Chicago and Northern Illinois which hinders economic growth. Other similar jurisdictions have observed electrical power rate differential ranging from 17% to 30% less. The city hired the firm of R.W. Beck and Associates to analyze three broad options: (1) renegotiation of the franchise agreement between the City and Edison; (2) development of a power purchase authority; and (3) establishment of a new municipal electric utility. Six options are outlined. (1) Municipal utility with purchased power resources. (2) Acquisition of an ownership interest in the Commonwealth Edison system. (3) Municipal power purchase authority. (4) Permitting competition in utility service areas. (5) Northern Illinois regional power authority. (6) Renegotiate the franchise. Estimated cost reductions were derived primarily from: (1) the City's tax exempt status with respect to federal and state income taxes; (2) a lower estimated rate of growth in the City's energy requirements as compared to the total Edison load area; (3) the current excess capacity in the Midwest; (4) the scheduling of a lower level of generating capacity reserves by the City than that which is projected to exist on the Edison system for several years; and (5) the city's implementation of conservation measures.

642 (DOE/CH/10348–1, pp. 131-152) **Clean-coal technologies - a Midwest project update.** Siegel, J.S. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

The Clean Coal Technology (CCT) program is discussed. For power generation, clean coal technologies include those that improve the economies, thermal efficiency and environmental performance. They can be built in modules to minimize the concerns associated with possible adverse prudency decisions by State public Utility Commissions. A variety of coals can be used and they can be used to repower existing coal-fired boilers to extend plant life, increase power output and reduce emissions. Power generating CCT's include: fluidized bed combustion, integrated gasification combined cycle, fuel cells, direct coal fired turbines and MHD. Pollution control of sulfur dioxide, nitrogen oxides and other pollutants is provided. Some CCT's can also be used to convert coal to liquids or gases that can be used to replace petroleum-based liquids or natural gas. Activities now in progress on projects range from initial fact finding on those recently selected to various stages of construction or operation. The availability of demonstrated CCT and hardware will give America a substantial marketing advantage overseas. Worldwide consumption of coal is expected to increase by more than one-third by the end of the century due to growth in coal-fired electric generating capacity. The improved technologies will meet the environmental objectives of the international community.

643 (DOE/CH/10348–1, pp. 153-158) **Achieving an energy-secure economy: Options for Illinois and the Midwest.** Etchison, D. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

This paper focuses on the Illinois energy security situation, discusses policy considerations and reviews major energy provisions of the Free Trade Agreement with Canada. Illinois is much like the United States in the global scene of energy. Illinois ranks sixth in population with 12 million people, and is a big energy producer, consumer, exporter and importer. The state ranked fourth nationally in 1985 for total energy expenditures of $21 billion. Exports are mostly coal and ethanol, with significant amounts of oil and natural gas imported. Excess capacity exists in electricity. The purpose of the agreement with Canada is to liberalize the trading and investment relationships. US consumers will have access to Canadian energy supplies at the same prices Canadians pay. Canada is the number one supplier of oil to the US with some 280 million barrels annually. Canadian oil, gas and electricity coming into the US amounts to about $10 billion annually, with about $1 billion being the Illinois portion. In summary, tremendous changes are underway in every sector, new oil and gas exploration techniques, new clean coal technologies, energy conservation and efficiency efforts, planning least cost options, and research and development of alternative energy sources. In this temporary period of energy surplus, it is important to keep business, government leaders and the public aware of the need to not waste energy, but use it wisely and efficiently.

644 (DOE/CH/10348–1, pp. 161-189) **Free market economics: Graphs and figures.** Eck, T. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

Energy statistics and issues are illustrated with charts and graphs: Energy & Oil intensities for market economies; US Electricity and energy growth; US Energy consumption MM B/D COE per $ Tril (1982) GNP; Relative producer prices fuel and power to finished goods; US Well head crude oil price and exploration and development expenditures; Monthly rig count; Rigs operating in US; US Oil supply and demand likely case: Oil imports as % of US demand; US Oil demand by major product; Fuel consumption, MB/D; Passenger car statistics; Cost of Reid vapor pressure reduction; Cost of 4 percent oxygenated gasoline (ex subsidies); Diesel specifications (%); US Natural gas production & imports; Natural gas imports from Canada; Potential new gas markets; Potential gas market for electricity generation; Natural gas deregulation; Pipeline rate design problems; Methods of allocating pipeline capacity; Competitive forces in transportation; Take-or-pay NOPR; Current gas sales contracts; Canadian natural gas supply and demand; and Repeal the windfall profit tax.

645 (DOE/CH/10348–1, pp. 191-208) **Advances in applied superconductivity.** Wolsky, A.M. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

Charts and graphs are provided to illustrate status and advances in applied superconductivity.

2940 Fossil Fuels

Refer also to citation(s) 1, 13, 26, 27, 38, 39, 40, 41, 42, 43, 44, 49, 54, 59, 65, 67, 69, 70, 71, 72, 73, 74, 75, 76, 80, 81, 82, 83, 84, 85, 91, 92, 94, 95, 96, 97, 98, 99, 108, 109, 110, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 639, 643, 648, 747, 748

646 **State Mining and Mineral Resources Research Institute Program. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2240, June 27, 1988.** S. Hrg. 100-849. 64p. Government Printing Office, Washington, DC (US) (1988).

The hearing was called to examine S.2240 which would reauthorize the State Mining and Mineral Resources Research Institute Program. The purpose of the Institute Program is to stimulate research and training of engineers and scientists and mining and mineral resources and technology. There are currently 32 Institutes under the program yielding practical results and making a significant contribution to mining and mineral development in the US. The bill continues the requirement that in order to participate institutional and industrial commitment must be demonstrated. The text of the

bill is presented and testimony is heard from two witnesses, the director of energy and water research from West Virginia University and the Chief Staff Officer from the Bureau of Mines, DOI. Statements from the Senators from Kentucky and Montana are included.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 596, 597

647 (PB–89-216105/XAB) **Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report.** Scheld, H.W.; Cameron, G.N.; Lester, L.J.; Mason, S.I. Simco, Inc., Weston, CT (USA). 15 Dec 1983. 59p. Available from NTIS, PC A04/MF A01.

Color illustrations reproduced in black and white.

The general data base on the biology of the Chinese tallow tree (sapium sebiferum (L.) Roxb.) was expanded and specific data regarding its genetics and ecology were developed. A morphmetric study and a genetic characterization of the tree was made via isozyme electrophoresis as a basis for a crop-improvement program. Both flowers and seeds were analyzed electrophoretically. Observations were begun of the environmental effects of tallow forest and assessment of possible monoculture effects aimed at predicting impact upon the human environment and predicting potential pest and disease problems associated with large-scale cultivation of the tree. Average temperature was slightly higher in a prairie near the tallow forest, but probably was not different enough to adversely effect prairie organisms.

2960 Electric Power

Refer also to citation(s) 99, 319, 321, 630, 638, 639, 641, 642, 643, 748

648 (DOE/EIA–0035(89/07)) **Monthly energy review, July 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 26 Oct 1989. 139p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002594. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Monthly Energy Review presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities.

649 (EPRI-EL–6503) **Power system planning and engineering–research needs and priorities: Proceedings.** Daniel, S.L. Jr. Electric Power Research Inst., Palo Alto, CA (USA); Southern Co. Services, Inc., Birmingham, AL (USA). c Oct 1989. 90p. Sponsored by Electric Power Research Institute. (CONF-8903170–Summ.: Power system planning and engineering: research needs and priorities, Houston, TX (USA), 14-16 Mar 1989). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The objective of this workshop, entitled Power System Planning and Engineering: Research Needs and Priorities, was to identify and prioritize a list of topics suitable for EPRI research projects. These projects address the problems and challenges in the power system planning and engineering areas. The workshop focused on research and development of new concepts, methods, planning practices, guidelines, mathematical techniques, and computational tools.

650 (GAO/RCED–89-43) **Federal electric power: Controversy relating to construction of transmission lines.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 30p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Western Area Power Administration in the Department of Energy markets electric power generated by federal hydroelectric dams in 15 central and western states. Western is planning to construct the Craig/Bonanza transmission line and the controversy involves the questioning of Western's role in the project by an investor-owned utility. This controversy is discussed in this paper. GAO found no legal basis to question Western's general authority to construct this project.

651 (PB–89-214936/XAB) **Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report.** SVL Associates, Laguna Hills, CA (USA). May 1989. 232p. Available from NTIS, PC A11/MF A01.

The study concludes that while the diversification into nonutility activities by the Rural Electric Cooperatives and the Rural Telephone Cooperatives has been expanding, the regulatory activities by the Rural Electrification Administration and the state public utility commissions have been inadequate to guard against cross-subsidization. In fact, there generally exist no data to identify and investigate illegal cross-subsidization activities of cooperatives. Increasing the regulatory functions of state public utility commissions and the REA was recommended.

2980 Consumption and Utilization

Refer also to citation(s) 636, 638, 640, 648, 680, 681

652 (EPRI-CU–6487) **Residential end-use energy consumption: A survey of conditional demand estimates: Final report.** Sebold, F.D.; Parris, K.M. Electric Power Research Inst., Palo Alto, CA (USA); Cambridge Systematics, Inc., Berkeley, CA (USA); Regional Economic Research, Inc., San Diego, CA (USA). c Oct 1989. 61p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the results of a survey and analysis of recent estimates of residential end-use unit energy consumption (UEC) levels obtained through a statistical analysis procedure known as conditional demand analysis. Methodological issues are discussed, and UEC estimates reported for a wide range of utility service areas, along with estimates, in some cases, of price and income elasticities. Many utilities now use an end-use approach for forecasting residential energy sales, and as part of their DSM/market planning activities. However, few have access to end-use metered data to be used in the development of these forecasts and analyses. Conditional demand analysis provides a statistical means of estimating UECs from available billing record data on monthly energy consumption, and customer information derived from appliance saturation surveys. This approach is beginning to see relatively wide use at electric utilities, as evidenced by the large number of studies included in this survey. A general review of conditional demand methodology is presented to explain the logic of the approach and to introduce the means of integrating technical and behavioral factors into the model specification. Then, individual end uses are considered. For each end use, alternative specifications are presented, UEC estimates are summarized, and the transferability of estimates across service areas is assessed. In reporting weather-sensitive UECs, an attempt is made to standardize for the weather-related variation in estimates across service areas. 39 refs., 19 figs., 21 tabs.

653 (ORNL/CON–289) **Electricity savings and one and two years after weatherization: A study of 1986 participants in Bonneville's Residential Weatherization Program.** Schweitzer, M.; Brown, M.A.; White, D.L. Oak Ridge National Lab., TN (USA). Sep 1989. 63p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC05-84OR21400. Order Number DE90001850. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This study is the latest in a series of evaluations of the Bonneville Power Administration's Residential Weatherization Program (RWP). Data were collected from households weatherized in 1986 under Bonneville's Long Term RWP and from a control group of nonparticipants. The households selected come from eight different utilities throughout Bonneville's service area. In 1986, 83% of audit-recommended measures were installed by program participants, approximately the same percentage as in previous years. Also as in previous years, the installation rate was higher for recommended measures with greater estimated energy savings. While Bonneville's retrofit costs have remained fairly constant over time, total retrofit costs have increased from $1,700 in 1982 to $2,400 in 1986 (in 1986-$), with the additional costs absorbed by participating households and utilities. Similarly Bonneville's cost per estimated kWh of first-year electricity savings has stayed at about 27 cents/kWh while the average total cost has risen from 28 cents/kWh in 1982 to 44

cents/kWh in 1986 (in 1986-$). For the RWP overall, savings experienced by 1986 participants were substantial. During the first year after weatherization, weighted net savings averaged 2,800 kWh, or 12% of the previous year's energy consumption. In the second post-weatherization year, a weighted average of 2,500 kWh was saved, amounting to 11% of pre-weatherization energy use. Levelized costs were 46 mills per kilowatt hour saved, which is at the low end of the range of cost estimates for a new coal coal plant. Since the 1981 Pilot Program, energy savings have declined and costs have risen. Nevertheless, the energy savings and associated costs of the 1986 Long Term RWP indicate that cost-effective savings can still be achieved by this type of conservation program. 28 refs., 8 figs., 19 tabs.

654 (PNL-SA–16957) **Residential energy efficiency and fuel choice.** Lee, A.D.; Englin, J.; Harkreader, S. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 11p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-890845–5: 4. international energy conservation program evaluation conference, Chicago, IL (USA), 21-25 Aug 1989). Order Number DE89016820. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This evaluation involved the Bonneville Power Administration's (Bonneville's) Early Adopter Program (EAP), which promotes early adoption of the Northwest Model Conservation Standard (MCS) for new residential buildings heated with electricity. The energy efficiency improvements required by the MCS are likely to increase construction costs and possible reduce demand for new electrically heated homes. The purpose of the evaluation was to provide a preliminary assessment of fuel preferences and how the MCS affects residential fuel choice. A survey of households in two EAP regions was conducted and analyzed. Housing sales price data were collected in Tacoma, Washington, and hedonic price analysis was used to determine the effect of the MCS and different fuel types on housing price. Focus groups were held with Tacoma builders, and conjoint analysis was used to determine what factors most influenced the installation of specific fuel. The results showed that homeowners consider several fuel characteristics to be important in their fuel choice. Analysis of sales price data in Tacoma showed that buyers had paid more for gas-heated homes in recent years, probably reflecting recent sharp increases in the relative price of electricity. In addition, it appeared that buyers in Tacoma had paid considerably more for homes built to the MCS than electrically heated homes built to previous standards. Builder information suggested that buyer preferences were the main factor determining what fuel a builder would install. 7 refs., 1 fig., 3 tabs.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 595, 603, 747, 748

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

655 (DOE/PC/88653–T1) **Development of a wet vapor homogeneous liquid metal MHD power system: Semi-annual report, October 1988–March 1989.** Solmecs Ltd., Jerusalem (Israel). Apr 1989. 49p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88653. Order Number DE90001468. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the period covered by this report (October 1988–March 1989), the following work was done: the mixing stream condensation process was analyzed, and a theoretical model for simulating this process was modified. A parametric study is being conducted at the present time; the separation processes were analyzed; and the experimental system was specified and its design is at present in an advanced stage. The mixing stream condensation process was analyzed. For the parameters defined in the SOW of this project the process was found to be a mist flow direct contact condensation, where the hot gas mixture consisting of inert gas and vapor is the continuous phase, and the subcooled liquid on which the vapor is condensed if the droplets dispersed phase. Two possibilities of creating the mist flow were considered. The first, injecting the cold Liquid Metal (LM) into the Mixing Streams Condenser (MSC) entrance as a jet and breaking it into LM fragments and the fragments into droplets by momentum transfer breakup mechanism. The second, atomizing the cooled LM stream into little droplets (approximately 100 μm in diameter) and accelerating them by the gas. The second possibility was preferred due to its much higher heat and mass transfer surface and coefficients relative to the first one. 3 refs., 13 figs.

3004 Thermionic Converters

656 **Characterization of compliant thermal conductive tungsten material for thermionic element application.** Trujillo, V. (Los Alamos National Lab., Los Alamos, NM (US)); Merrigan, M.; Ranken, W. vp of Proceedings of the 23rd intersociety energy conversion engineering conference. Goswami, D.Y American Society of Mechanical Engineers, New York, NY (1988). (CONF-880702–: 23. intersociety energy conversion engineering conference, Denver, CO (USA), 31 Jul - 5 aug 1988).

Technical Paper 889296.

Development and characterization of two compliant, thermally conductive, tungsten-based materials is discussed. The materials developed are intended for use in the Thermionic Fuel Element (TFE) Verification program. Operating life of TFE elements can be improved through the use of a structurally weak thermal coupling medium between the UO_2 fuel cylinder and the tungsten cladding that surrounds it. The thermal coupling material absorbs fuel swelling and reduces stress of the tungsten emitter element. A low-density tungsten-based material with a conductivity of 1-2% of solid tungsten satisfies the requirements for the compliant material. Two different compliant structures were developed and their thermal properties were determined for two temperature ranges. Thermal conductance as a function of sample density was determined at ambient temperature. Details of the test procedures and results of the tests are presented in this paper with a discussion of the anticipated effects on thermionic element lifetime.

3005 Fuel Cells

Refer also to citation(s) 564

657 (DOE/MC/23270–2751) **Molten carbonate fuel cell technology improvement: Quarterly technical progress report No. 17 for period ending May 1989.** International Fuel Cells Corp., South Windsor, CT (USA). Sep 1989. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC23270. Order Number DE90001934. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of this program is to define a competitive CG/MCFC power plant and the associated technology development requirements and to develop an improved cell configuration for molten carbonate fuel cells which has improved performance, has reduced cell creep and electrolyte management consistent with 40,000 hour projected life, reduces existing cell cost, and is adaptable to a range of power plant applications. Component design specifications for the end-cells of the alternative cell configuration were completed. Testing to evaluate new components was performed on 14 cells during this reporting period with eight tests started and terminated, and six tests continuing into the next reporting period. A test and performance summary of all the single cell tests conducted to date on this program is presented in Table 1. A single cell test to qualify new matrix materials and matrix reinforcement was successfully completed. Integrated cell testing of new anode- and cathode-side components was completed. Single cell tests were conducted to identify the electrolyte fill procedure for the new cell configuration. Methods of fabricating manifold seals from the new candidate materials are being developed. Preparation of construction drawings for the 1-ft^2 short stack was continued. Fabrication of repeating cell components for the 1-ft^2 short stack was initiated. Trials to tape cast electrodes and matrices were initiated, tooling to form current collectors is being fabricated, and existing

tooling to form separator plates is being modified. Non-repeat components from the previous 1-ft^2 short stack that are acceptable for re-use were identified. New non-repeat components that are required have been ordered. Preparation of the test stand for the 1-ft^2 short stack test was initiated. 2 figs., 3 tabs.

658 (N–89-22982, pp. 9) **Monolithic solid oxide fuel cell development.** Myles, K.M.; McPheeters, C.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

The Monolithic Solid Oxide Fuel Cell (MSOFC) is an oxide-ceramic structure in which appropriate electronic and ionic conductors are fabricated in a honeycomb shape similar to a block of corrugated paperboard. These electronic and ionic conductors are arranged to provide short conduction paths to minimize resistive losses. The power density achievable with the MSOFC is expected to be about 8 kW/kg or 4 kW/L, at fuel efficienceis over 50 percent, because of small cell size and low resistive losses in the materials. The MSOFC operates in the range of 700 to 1000 C, at which temperatures rapid reform of hydrocarbon fuels is expected within the nickel-YSZ fuel channels. Tape casting and hot roll calendering are used to fabricate the MSOFC structure. The performance of the MSOFC has improved significantly during the course of development. The limitation of this system, based on materials resistance alone without interfacial resistances, is 0.093 ohm-sq cm area-specific resistance (ASR). The current typical performance of MSOFC single cells is characterized by ASRs of about 0.4 to 0.5 ohm-sq cm. With further development the ASR is expected to be reduced below 0.2 ohm-sq cm, which will result in power levels greater than 1.4 W/sq cm. The feasibility of the MSOFC concept was proven, and the performance was dramatically improved. The differences in thermal expansion coefficients and firing shrinkages among the fuel cell materials were minimized. As a result of good matching of these properties, the MSOFC structure was successfully fabricated with few defects, and the system shows excellent promise for development into a practical power source.

659 (N–89-22982, pp. 16-17) **Recent advances in solid polymer electrolyte fuel cell technology with low platinum loading electrodes.** Srinivasan, S.; Manko, D.J.; Enayatullah, M.; Appleby, A.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

High power density fuel cell systems for defense and civilian applications are being developed. Taking into consideration the main causes for efficiency losses (activation, mass transport and ohmic overpotentials) the only fuel cell systems capable of achieving high power densities are the ones with alkaline and solid polymer electrolyte. High power densities (0.8 W/sq cm at 0.8 V and 1 A/sq cm with H2 and O2 as reactants), were already used in NASA's Apollo and Space Shuttle flights as auxiliary power sources. Even higher power densities (4 W/sq cm - i.e., 8 A sq cm at 0.5 V) were reported by the USAF/International Fuel Cells in advanced versions of the alkaline system. High power densities (approximately 1 watt/sq cm) in solid polymer electrolyte fuel cells with ten times lower platinum loading in the electrodes (i.e., 0.4 mg/sq cm) were attained. It is now possible to reach a cell potential of 0.620 V at a current density of 2 A/sq cm and at a temperature of 95 C and pressure of 4/5 atm with H2/O2 as reactants. The slope of the linear region of the potential-current density plot for this case is 0.15 ohm-sq cm. With H2/air as reactants and under the same operating conditions, mass transport limitations are encountered at current densities above 1.4 A/sq cm. Thus, the cell potential at 1 A/sq cm with H2/air as reactants is less than that with H2/O2 as reactants by 40 mV, which is the expected value based on electrode kinetics of the oxygen reduction reaction, and at 2 A/sq cm with H2/air as reactant is less than the corresponding value with H2/O2 as reactants by 250 mV, which is due to the considerably greater mass transport limitations in the former case.

660 (N–89-22982, pp. 18) **The application of Dow Chemical's perfluorinated membranes in proton-exchange membrane fuel cells.** Eisman, G.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Dow Chemical's research activities in fuel cell devices revolves around the development and subsequent investigation of the perfluorinated inomeric membrane separator useful in proton-exchange membrane systems. Work is currently focusing on studying the effects of equivalent weight, thickness, water of hydration, pretreatment procedures, as well as the degree of water management required for a given membrane separator in the cell. The presentation will include details of certain aspects of the above as well as some of the requirements for high and low power generation.

661 (N–89-22982, pp. 19-20) **Hydrogen-oxygen proton-exchange membrane fuel cells and electrolyzers.** Baldwin, R. (Hamilton Standard, Windsor Locks, CT (USA)); Pham, M.; Leonida, A.; Mcelroy, J.; Nalette, T. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Hydrogen-oxygen SPE fuel cells and SPE electrolyzers (products of Hamilton Standard) both use a Proton-Exchange Membrane (PEM) as the sole electrolyte. The SPE cells have demonstrated a ten year life capability under load conditions. Ultimate life of PEM fuel cells and electrolyzers is primarily related to the chemical stability of the membrane. For perfluorocarbon proton-exchange membranes an accurate measure of the membrane stability is the fluoride loss rate. Millions of cell hours have contributed to establishing a relationship between fluoride loss rates and average expected ultimate cell life. Several features were introduced into SPE fuel cells and SPE electrolyzers such that applications requiring greater than or equal to 100,000 hours of life can be considered. Equally important as the ultimate life is the voltage stability of hydrogen-oxygen fuel cells and electrolyzers. Here again the features of SPE fuel cells and SPE electrolyzers have shown a cell voltage stability in the order of 1 microvolt per hour. That level of stability were demonstrated for tens of thousands of hours in SPE fuel cells at up to 500 amps per square foot (ASF) current density. The SPE electrolyzers have demonstrated the same at 1000 ASF. Many future extraterrestrial applications for fuel cells require that they be self recharged. To translate the proven SPE cell life and stability into a highly reliable extraterrestrial electrical energy storage system, a simplification of supporting equipment is required. Static phase separation, static fluid transport and static thermal control will be most useful in producting required system reliability. Although some 200,000 SPE fuel cell hours were recorded in earth orbit with static fluid phase separation, no SPE electrolyzer has, as yet, operated in space.

662 (N–89-22982, pp. 21-22) **Electrocatalysts for oxygen electrodes in fuel cells and water electrolyzers for space applications.** Prakash, J.; Tryk, D.; Yeager, E. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

In most instances separate electrocatalysts are needed to promote the reduction of O2 in the fuel cell mode and to generate O2 in the energy storage-water electrolysis mode in aqueous electrochemical systems operating at low and moderate temperatures (T greater than or equal to 200 C). Interesting exceptions are the lead and bismuth ruthenate pyrochlores in alkaline electrolytes. These

catalysts on high area carbon supports have high catalytic activity for both O2 reduction and generation (1,2). Rotating ring-disk electrode measurements provide evidence that the O2 reduction proceeds by a parallel four-electron pathway. The ruthenates can also be used as self-supported catalysts to avoid the problems associated with carbon oxidation, but the electrode performance so far achieved in the research at Case Western Reserve University (CWRU) is considerably less. At the potentials involved in the anodic mode the ruthenate pyrochlores have substantial equilibrium solubility in concentrated alkaline electrolyte. This results in the loss of catalyst into the bulk solution and a decline in catalytic activity. Furthermore, the hydrogen generation counter electrode may become contaminated with reduction products from the pyrochlores (lead, ruthenium). A possible approach to this problem is to immobilize the pyrochlore catalyst within an ionic-conducting solid polymer, which would replace the fluid electrolyte within the porous gas diffusion O2 electrode. For bulk alkaline electrolyte, an anion-exchange polymer is needed with a transference number close to unity for the Oh(-) ion. Preliminary short-term measurements with lead ruthenates using a commercially available partially-fluorinated anion-exchange membrane as an overlayer on the porous gas-fed electrode indicate lower anodic polarization and virtually unchanged cathodic polarization.

663 (N–89-22982, pp. 23-24) **Oxygen electrodes for rechargeable alkaline fuel cells.** Swette, L.; Kackley, N. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Electrocatalysts and supports for the positive electrode of moderate temperature single-unit rechargeable alkaline fuel cells are being investigated and developed. Candidate support materials were drawn from transition metal carbides, borides, nitrides and oxides which have high conductivity (greater than 1 ohm/cm). Candidate catalyst materials were selected largely from metal oxides of the form ABO sub x where A = Pb, Cd, Mn, Ti, Zr, La, Sr, Na, and B = Pt, Pd, Ir, Ru, Ni (Co) which were investigated and/or developed for one function only, O2 reduction or O2 evolution. The electrical conductivity requirement for catalysts may be lower, especially if integrated with a higher conductivity support. All candidate materials of acceptable conductivity are subjected to corrosion testing. Materials that survive chemical testing are examined for electrochemical corrosion activity. For more stringent corrosion testing, and for further evaluation of electrocatalysts (which generally show significant O2 evolution at at 1.4 V), samples are held at 1.6 V or 0.6 V for about 100 hours. The surviving materials are then physically and chemically analyzed for signs of degradation. To evaluate the bifunctional oxygen activity of candidate catalysts, Teflon-bonded electrodes are fabricated and tested in a floating electrode configuration. Many of the experimental materials being studied have required development of a customized electrode fabrication procedure. In advanced development, the goal is to reduce the polarization to about 300 to 350 mV. Approximately six support materials and five catalyst materials were identified to date for further development. The test results will be described.

664 (N–89-22982, pp. 25-26) **Non-noble electrocatalysts for alkaline fuel cells.** Sarangapani, S.; Lessner, P.; Manoukian, M.; Giner, J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

Carbons activated with macrocyclics have attracted increasing attention as alternative electrocatalysts for oxygen reduction. Initial activity of these catalysts is good, but performance declines rapidly. Pyrolyzing the macrocyclic on the carbon support leads to enhanced stability and the catalysts retain good activity. The approach described is designed to develop bulk doped catalysts with similar structures to pyrolyzed macrocyclic catalysts. The transition metal and coordinated ligands are dispersed throughout the bulk of the conductive carbon skeleton. Two approaches to realizing this concept are being pursued, both involving the doping of carbon precursors. In one approach, the precursor is a solid phase carbon-containing ion-exchange resin. The precursor is doped with a transition metal and/or nitrogen, and the resulting mixture is pyrolyzed. In the other approach, the precursor is a gas-phase hydrocarbon. This is introduced with a transition metal species and nitrogen species into a reactor and pyrolyzed. Several studies have been conducted to determine if there is a synergistic effect between the transition metal and nitrogen and the effect of different methods of introducing the metal-nitrogen (M-N) coordination on performance. One approach was to introduce the metal and nitrogen separately, for example, by sequentially doping FeCl3 and NH4OH into the resin. Catalysts were prepared from an undoped ion-exchange resin, a resin doped only with N, a resin doped only with Fe, and a resin doped with both Fe and N. Introduction of nitrogen alone has no beneficial effect on the performance of the catalysts. The introduction of the Fe alone significantly improves the performance in both the high and low current density regions. When both Fe and N are introduced, the performance at lower current densities (catalytic activity) is increased beyond that of the Fe-doped carbon.

665 (N–89-22982, pp. 27) **Corrosion testing of candidates for the alkaline fuel cell cathode.** Singer, J.; Fielder, W.L. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. (NASA-CP–10029;E–4708;NAS–1.55:10029;CONF-8904196–: 2. space electrochemical research and technology conference, Cleveland, OH (USA), 11-13 Apr 1989). In *Space Electrochemical Research and Technology Conference: Abstracts.* Available from NTIS, PC A03/MF A01.

It is desirable to employ a corrosion screening test for catalyst or support candidates for the fuel cell cathode before entering upon optimization of the candidate or of the catalytic electrode. To this end, corrosion test electrodes, intended for complete immersion and maximum wetting, have been made with 30 to 40 vol. pct Teflon; with perovskites this is about 10 to 15 pct. The candidates were synthesized by methods intended for single-phase product without special emphasis on high surface area, although the substances tested were no coarser than 2 m squared/g. A typical loading was 25 mg/cm sq of the pure substance, usually on gold screen, a few mm squared of which were left bare for contacting. Contact to the gold lead wire was made by welding with a micro-torch or a spot-welder. Corrosion testing consisted of obtaining current-voltage data under flowing inert gas in the potential region for reduction of O2. The electrode was immersed in 30 pct KOH. Observations were made at 20 C and 80 C, and the results compared with data from gold standards. Results with some perovskites, pyrochlores, spinels, and interstitial compounds will be discussed.

666 **Hydrogen/oxygen fuel cells with in-situ product water removal.** Leonida, A. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Two designs for a hydrogen/oxygen fuel cell with efficient water product removal are presented. One of these H2/O2 cells, specifically designed for space, is based on the principle of in situ static water removal through a porous titanium plate. The design relies on a hydrophobic cathode electrode and the porous-plate bubble pressure to achieve the phase separation. The second cell, intended for terrestrial applications, takes advantage of the gravity field for collecting and separating water from the electrode. Schematic diagrams for the two cells are presented.

667 **Canadian solid polymer fuel cell development.** Watkins, D.; Dircks, K.; Epp, D. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

Recent technological developments in the field of solid polymer fuel cell (SPFC) systems for military and civilian applications are discussed. The performance of SPFC power section hardware is examined, including the performance of MK IV H2/O2, MK IV H2/

air, and MK IV reformed methanol/air cell stacks. An MK V 50-cell power section for a 4-kW methanol/air field-generator unit, which is currently under development, is described.

668 **Design and performance of an air-cooled ion exchange membrane fuel cell.** Rosso, M.J. Jr.; Golben, P.M.; Orlando, J.J.; Adlhart, O.J. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

An ion exchange membrane (IEM) fuel cell combined with hydride storage vessels provides an attractive alternative to secondary batteries. This paper discusses the principals of operation, general design features, and performance characteristics of air-cooled IEM cells. Designs of IEM H2/O2 and H2/air fuel cell systems are described in detail and illustrated with schematic diagrams.

669 **Proton exchange membrane fuel cells.** Meyer, A.P.; Clausi, J.V.; Trocciola, J.C. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The development objectives for a proton-exchange-membrane (PEM) fuel cells are discussed together with performance data obtained on an experimental PEM fuel cell stack, consisting of 15 cells, which feature passive removal of heat and water. The cell stack is cooled by natural convection via fins, while water is discharged as a liquid directly from the stack into an external collection container. The stack has presently accumulated more than 600 hours of operation; data taken after 10 h and 600 h of testing show no degradation of performance.

670 **'Hytec' - New concept for a thermally regenerative electrochemical cell.** Roy, P.; Armijo, J.S.; Gerrels, E.E. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

A hydrogen thermoelectrochemical converter system, named Hytec, is proposed for use as a high specific power device for space applications. The system uses H2 fuel with Li/LiH transport media, employing a cycle with potential efficiencies greater than or equal to 20 percent. The molten chloride electrolyte in the system is contained between two thin electrode membranes. The principle of operating the Hytec system is described and results from experiments to test the Hytec concept are discussed. It is suggested that the system would be a high power density (W/L) system with a specific energy (Wh/Kg) that is higher than most electrochemical conversion systems.

671 **European fuel cell research and development projects.** Kordesch, K.; Gsellmann, J.; Kalal, P.; Oliveira, J.C.T.; Steininger, K. pp. 874 of International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings. Electrochemical Society, Inc., Pennington, NJ (US) (1988). (CONF-880665–: 33. international power source symposium, Cherry Hill, NJ (USA), 13-16 Jun 1988).

The state of fuel cell systems technology in Europe is reviewed. The major developments in alkaline fuel cell systems research are outlined. Present research efforts in the field of alkaline fuel cell systems are listed, including the development of a 7/20 kW H-O fuel cell power plant with nonnoble metal catalysts and a 5-60 H2-air fuel cell power plant, plans for the fuel cell power plant for the Hermes space vehicle, and research concerning the commercial application of various fuel cell types. In addition, consideration is given to reseach on topics related to nonalkaline fuel cell systems such as a methanol cracking unit combined with a 1-2 kW phosphoric-acid fuel cell system with tungsten carbide anodes, direct cells with sulfuric acid, solid polymer electrolyte fuel cells, and medium-temperature solid oxide fuel cells. 15 refs.

672 **Fabrication of solid oxide fuel cell by electrochemical vapor deposition.** Brian, R.; Szreders, B.E. To Dept. of Energy, Washington, DC. USA Patent 4,831,965. 23 May 1989. Filed date 21 Apr 1988. Int. Cl. C23C 16/00. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

In a high temperature solid oxide fuel cell (SOFC), the deposition of an impervious high density thin layer of electrically conductive interconnector material, such as magnesium doped lanthanum chromite, and of an electrolyte material, such as yttria stabilized zirconia, onto a porous support/air electrode substrate surface is carried out at high temperatures (approximately 1100^0-1300^0C) by a process of electrochemical vapor deposition. In this process, the mixed chlorides of the specific metals involved react in the gaseous state with water vapor resulting in the deposit of an impervious thin oxide layer on the support tube/air electrode substrate of between 20-50 microns in thickness. An internal heater, such as a heat pipe, is placed within the support tube/air electrode substrate and induces a uniform temperature profile therein so as to afford precise and uniform oxide deposition kinetics in an arrangement which is particularly adapted for large scale, commercial fabrication of SOFCs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 634, 635

3201 Buildings

Refer also to citation(s) 100, 102, 280, 281, 627, 630, 633, 653, 654, 1267, 1273, 1288

673 (BRE-IP–1/89) **Domestic warm-air heating systems using low-grade heat sources.** Rayment, R.; Whittle, G.E. Building Research Establishment, Watford (UK). Jan 1989. 4p. Available from Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR.

The practicability of using warm-air distribution systems with low temperature heat sources, such as solar, heat pump, geothermal etc., has been demonstrated in an experimental test room. A wide range of conditions were studied and optimal air-supply rates and source temperatures for comfortable conditions have been determined. This paper is addressed to building services engineers, architects, heating suppliers and installers, housing authorities and others concerned with the provision of heating in housing. (author).

674 (BRE-IP–2/89) **Thermal performance of lightweight inverted warm deck flat roofs.** Beech, J.C.; Saunders, G.K. Building Research Establishment, Watford (UK). Jan 1989. 4p. Available from Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR.

BRE research indicates that when the inverted warm deck roof is used in conjunction with a lightweight deck, thermal performance during rainfall may fall far enough below theoretical expectations in certain locations to allow risk of condensation in the roof. Further work validates a simple modification to the design which could be incorporated to reduce this risk. These findings will be of value to designers and architects considering the use of the inverted flat roof option. (author).

675 (BRE-IP–22/88) **Energy efficiency in the housing stock.** Henderson, G.; Shorrock, L.D. Building Research Establishment, Watford (UK). Dec 1988. 4p. Available from Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR.

A model of energy use in the UK housing stock has been developed by the Building Research Establishment. The model, called BREHOMES, combines data from various surveys with a physical model of domestic energy consumption to produce a coherent picture of overall energy use. The results show that the average dwelling is now more energy efficient than in 1970, being much better heated yet using a similar amount of energy. This paper is addressed to all those concerned with improving energy efficiency in buildings including architects, builders, builders' suppliers, housing authorities, their managers and technical staff. (author).

676 (CONF-8808273–Suppl.) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Index volume, Subject and author index.** American Council for an Energy-Efficient

Economy, Washington, DC (USA). c Aug 1988. 71p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., Washington, DC 20036.

The conference proceedings include eleven volumes of technical papers project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

677 (CONF-8808273–Vol.1) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 1, Single-family building technologies.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 171p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

The theme of this year's summer study panel on single-family building technology clearly reflects the growing industry concern with infiltration control and its effects on indoor air quality. In past years, the development of more energy efficient housing focused on insulation levels in floors, walls and ceilings, high performance glazing, and more efficient mechanical systems. In recent years, innovations in infiltration control have dominated energy research for both new construction and retrofits. This year we are seeing a maturing of the work in infiltration control techniques with greater concern for making infiltration control more cost effective, as well as for the effects of reduced infiltration on indoor air quality. The conference proceedings include eleven volumes of technical and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

678 (CONF-8808273–Vol.2) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 2, Multifamily building technologies.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 194p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

Multifamily research has increased substantially since the first ACEEE Summer Study. The growth is most welcome, since this large sector (27% of the existing US housing stock), which has a disproportionate share of low income households, was mostly neglected in the period immediately following the energy crisis. Multifamily research presented at the Summer Studies had focused primarily on low rise buildings in the 4 to 100 unit range. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

679 (CONF-8808273–Vol.4) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 4, Appliances and equipment.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 142p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

The scope of the papers and presentations in Panel 4 of the ACEEE 1988 Summer Study address a broad range of topics from technology and market assessment through comparison of rated equipment performance with as installed field performance. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

680 (CONF-8808273–Vol.6) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 6, Utility and private sector conservation programs.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 194p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

This panel is concerned with all the activities being undertaken by utilities to consider demand-side program approaches. We believe this panel provides a rich menu of the activity currently taking place in demand-side utility activities. The design of programs, implementation considerations and evaluation issues are discussed. While some of the more traditional utility approaches are covered, there is also an emphasis on the newer program directions. In fact the emphasis of this panel is on the lessons learned from traditional and innovative program approaches. What are we learning from market research? What have we learned from implementing programs? What has the marketplace taught us? What do we think the new directions will be given what we have learned? The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

681 (CONF-8808273–Vol.8) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 8, Planning and forecasting.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 291p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

In many respects, planning and forecasting represent the "glue" that binds together the panels, sessions, and papers presented at this ACEEE conference on Energy Efficiency in Buildings. Integrated resource planning, demand-side planning, and load forecasting are necessary prerequisites to the energy-efficiency programs operated by government agencies, electric and gas utilities, and other institutions. Before these organizations can adopt programs to affect the investment and operating decisions of building owners and managers, they must collect and analyze data on economic activity, energy-use patterns and trends, conservation resources, supply resources, and the interactions among these factors. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

682 (CONF-8808273–Vol.9) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 9, Program evaluation.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 222p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

Over the last ten years, the role and sophistication of program evaluations have grown in parallel with the Summer Study. Conservation program evaluation has become a large field with many good

practitioners. Those represented in this panel represent a variety of affiliations: universities, national laboratories, state agencies, public and private utilities, and private consultants. We feel the papers represented here are valuable contributors to the Summer Study. They were selected out of 70 abstracts. Nevertheless, many excellent evaluators could not be represented due to the time constraints and competing interests of the Summer Study. An entire conference on energy program evaluation is held every two years in Chicago (organized by Argonne National Laboratory) which should be of interest to those who find the papers in the panel to be useful. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

683 (CONF-8808273–Vol.10) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 10, Performance measurement and analysis.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 284p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

The goal of an energy-efficient economy is to use limited resources as effectively as possible to provide for societal needs. The goal of the conservation program manager is to use limited institutional resources as effectively as possible to achieve energy efficiency improvements in the sector of interest. The goal of performance monitoring is to use limited monitoring resources as effectively as possible to provide useful information to program managers and other decision makers. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

684 (DOE/ID/12584–44) **Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989.** Pearson, M.D. UNC Geotech, Grand Junction, CO (USA). Technical Measurements Center. Aug 1989. 41p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-86ID12584. Order Number DE90002039. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center (TMC) to provide standardization, calibration, comparability, verification of data, quality assurance, and cost-effectiveness for the measurement requirements of DOE remedial action programs. These programs include the Uranium Mill Tailings Remedial Action (UMTRA) Program, the Surplus Facilities Management Program (SFMP), the Formerly Utilized Sites Remedial Action Program (FUSRAP), and the Grand Junction Remedial Action Program (GJRAP). The Technical Measurements Center is located in Colorado at the DOE Grand Junction Projects Office. One of the remedial-action measurement needs is the estimation of average indoor radon-daughter concentration (RDC). The Technical Measurements Center sponsored a technical exchange meeting during the period April 10–14, 1989, for the purpose of providing an opportunity for comparison of radon-daughter grab-sample measurements by remedial action contractors. The Radon/Radon-Daughter Environmental Chamber at the DOE Grand Junction Projects Office (GJPO) was used for the meeting. The meeting findings indicate that comparable results for radon-daughter grab-sample measurements can be obtained by technicians using a variety of instruments. Technicians should be particularly aware of problems with inaccurate air volume measurements and mistakes in data reduction programs as sources of error. 3 refs., 14 figs., 4 tabs.

685 (DOE/SF/16667–T1) **Post-construction activities; Passive and hybrid solar low energy buildings: Design information booklet number eight.** Blum, S.; Holtz, M.J.; Tavino, R.R. Architectural Energy Corp., Boulder, CO (USA). Aug 1989. 44p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-87SF16667. (IEA-SHAC-T–8.C.8). Order Number DE90000632. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

Post Construction Activities defines issues to be considered once the project is constructed and occupied. It addresses those elements of the passive solar building that are unique and may require special attention by the occupants. Performance evaluation of the home in terms of energy performance, comfort and occupant satisfaction is also addressed as a means of providing information back to the designer on how well the project is performing.

686 (EEO-ED–142/31) **Energy management on a medium-sized pharmaceutical production plant. Demonstration at Reckitt and Colman Ltd. [Kingston-upon-Hull].** Department of Energy, London (UK). Energy Efficiency Office. Feb 1988. 46p. Order Number DE90713720. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

An energy management system (EMS) installed at a pharmaceutical production plant has significantly reduced energy consumption for the site. The system cost Pound 302,244 to install and resulted in financial savings of Pound 147,520/year indicating a payback period of approximately two years. The initial impetus for installing an EMS came from the management's desire to increase energy savings after already implementing a number of energy saving measures. These included heat recovery; improvements to zoning, lighting and control functions; and the introduction of good housekeeping techniques. The EMS employed - a Johnson Controls JC 85/40 -is suitable for medium to large buildings and provides HVAC control, load management, energy management and lighting control. In its basic form, it supports 500 data points although this can be extended to 3,200 points if required. Initially, it served new production and warehouse buildings on the site but it was so successful that it was extended to some of the older buildings as well. These included offices and workshops and further production and warehouse facilities. Most of the energy used on the site provides heating and air conditioning. Since its installation, the EMS has operated satisfactorily and been relatively free of problems. (author).

687 (EEO-ED–206/228) **Combined heat and power in a university hall of residence. A demonstration at the University of Keele.** Department of Energy, London (UK). Energy Efficiency Office; FEC Consultants Ltd., Oldham (UK). Oct 1988. 44p. Order Number DE90713729. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

As part of an on-going energy efficiency programme, the University of Keele, in 1985, installed a small-scale packaged combined heat and power plant (CHP) at a cost of Pound 25,740, to supply domestic hot water and electricity to a hall of residence situated on the campus. During a two year monitoring period energy savings worth a total of Pound 8,700 were achieved giving a payback period of 5.9 years on the original investment. However, based on recent performance and energy prices (January 1988), annual savings of Pound 5,500 are now considered realistic. This, in turn, gives a reduced payback period of 4.7 years. Operation of the CHP system has generally been good apart from initial problems due to oil starvation and the need to upgrade certain components. However, attention to the carburation and throttle linkage is required on a regular basis if electrical output and system performance are to be maintained at the correct level. The project has demonstrated the viability of CHP installations in halls of residence and similar establishments, provided that maintenance costs are controlled and system performance is maintained. (author).

688 (EEO-ED–251/291) **Lighting management system for local control through the PABX network. A demonstration at Chase Manhattan Bank NA., London.** Department of Energy, London (UK). Energy Efficiency Office. Mar 1989. 39p. Order Number DE90713722. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Chase Manhattan Bank NA have installed a novel lighting management system in their London HQ building, which uses the telephone located on each desk as a primary means of control. A central microcomputer retains information regarding the arrangement of lights and telephones so that re-programming for changes in office layout are easily accomplished. A central time control facility ensures that lights not required after occupancy are turned off and the telephone may be used by any staff still present after hours to turn lights back on again. Arrangements have been made to ensure that no area is completely without light for safety purposes. This demonstration project has shown that there is a wide acceptance of the telephone as a means of switching lights, and coupled with central time control very impressive savings are possible. The technology is particularly suitable for office refurbishment projects where the installation of the necessary wiring can easily be undertaken. (author).

689 (LBL–8678-Rev.3) **DOE-2 Sample Run Book, Version 2.1D: Revision 3.** Lawrence Berkeley Lab., CA (USA). Jun 1989. 628p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89017727. Available from NTIS, PC A99/MF A01; OSTI; Order software packages fron National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

This package of updates to the DOE-2 documentation brings the previously published materials (with the exception of the Users Guide) up to Version 2.1D of the DOE-2 program. The user may verify that the program being used is 2.1D by checking the first page of the output and also the upper right hand heading of any output page of the computer printout. This document contains in concise form the basic information on all commands and keywords in the DOE-2 Building Description Language (BDL) as well as a number of supplementary tables and maps.

690 (LBL–8688-Rev.5) **DOE-2 BDL [Building Description Language] summary, Version 2.1D: Revision 5.** Lawrence Berkeley Lab., CA (USA). Jun 1989. 132p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89017726. Available from NTIS, PC A07/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

This package of updates to the DOE-2 documentation brings the previously published materials (with the exception of the Users Guide) up to Version 2.1D of the DOE-2 program. The user may verify that the program being used is 2.1D by checking the first page of the output and also the upper right hand heading of any output page of the computer printout. This document contains in concise form the basic information on all commands and keywords in the DOE-2 Building Description Language (BDL) as well as a number of supplementary tables and maps.

691 (LBL–8706-Suppl.-Rev.5) **DOE-2 Supplement, Version 2.1D: Revision 5.** Lawrence Berkeley Lab., CA (USA). Jun 1989. 506p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89017728. Available from NTIS, PC A21/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

This package of updates to the DOE-2 documentation brings the previously published materials (with the exception of the Users Guide) up to Version 2.1D of the DOE-2 program. The user may verify that the program being used is 2.1D by checking the first page of the output and also the upper right hand heading of any output page of the computer printout. This document contains in concise form the basis information on all commands and keywords in the DOE-2 Building Description Language (BDL) as well as a number of supplementary tables and maps.

692 (PB–89-229686/XAB) **Ventilation and air-quality investigation of the US Geological Survey building.** Dols, W.S.; Persily, A. National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Building Environment Div. Jul 1989. 44p. (NISTIR–89/4126). Available from NTIS, PC A03/MF A01.

The National Center of the U.S. Geological Survey in suburban Washington, DC is a seven-story building containing both office and laboratory space. Based on a history of occupant complaints regarding the air quality within the building, an investigation was conducted by the National Institute of Standards and Technology to quantify the ventilation characteristics of the building and to determine the indoor levels of selected indoor pollutants. The investigation of the building included measurements of air-exchange rates using the tracer-gas decay technique and measurements of indoor concentrations of carbon dioxide, carbon monoxide, radon, formaldehyde, and particulates. The measurement results are compared to appropriate standards and guidelines in order to investigate the role of ventilation and pollutant concentrations in the indoor-air-quality complaints. Based on the investigation, several recommendations are made to improve the environmental conditions within the building.

693 (SERI/SP–220-3220) **Energy conservation technical information guide: Volume 3, Residential buildings.** Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 109p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009468. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This guide is one of a set of energy-conservation technical information guides (TIGs) designed to bring you up to date on conservation technologies and help you find additional information. It is written for several audiences, especially local utility managers and state energy office personnel, who have a major interest in seeing that the residential sector--a major contributor to total energy consumption and peak demand-- becomes more energy efficient and better matches utility production capacity. However, utilities and energy offices can only influence, not control, the degree of energy efficiency and peak demand built into a new or remodeled home. The information in this guide is intended to help them influence both builders and buyers to select from currently available building techniques and equipment that are energy efficient and cost effective. This guide is neither a primer for beginners nor a how-to for builders. Rather, it assumes that the reader is familiar with basic building technology and wants to learn about the most up-to-date techniques and equipment available. Most of this guide focuses on structural elements and mechanical items that conserve energy and lessen or shift peak demand in new and existing homes. Topics range from energy-efficient walls and windows to high-performance heating systems and energy-conserving appliances. Further, information is provided about indoor air quality as it relates to energy-efficient housing. The guide also provides explanations of energy design and diagnostic tools and how energy use is monitored in homes. 113 refs.

3202 Transportation

Refer also to citation(s) 628, 741, 1466

694 (FDS–204/1988) **Statistical prediction of the ship's propulsive power.** Chirila, J.V.; Berger, G. Forschungszentrum des Deutschen Schiffbaus e.V., Hamburg (Germany, F.R.). 1988. 36p. (In German). Available from Copy held by UB/TIB Hannover.

A method for the prediction of propulsive power has been developed which enables to select from recorded towing tank results the propulsion data of ship models whose characteristics are similar to a designed ship. For this purpose a data base for recording available test results of the model-testing tanks in Berlin, Hamburg and Vienna has been established which can be enlarged by propulsion results to be obtained later on. Further a method has been developed which evaluates statistically the stored data and delivers it at the disposal for the prediction of propulsive power. For practical application a FORTRAN 77 computer program has been written which displays main dimensions and propulsion data as well as essential propulsion parameters of the ship to be designed and of the ships being found in the data base. By means of such selected propulsion parameters of comparable model tests it is possible to valuate the quality of a new ship design and to derive indications for the variation of its parameters. (orig.).

695 (NAL-TR-987) **Calculation of scramjet performance.** Masuya, Goro; Wakamatus, Yoshio. National Aerospace Lab., Chofu, Tokyo (Japan). Jul 1988. 32p. (In Japanese). Order Number DE89900735. Available from NTIS (US Sales Only), PC A03/MF A01.

Prediction calculation of the performance of an airframe-integrated scramjet engine was executed using a quasi-one-dimensional calculation program. On the side of low Mach numbers, it is occasionally difficult to keep the interior of the combustor supersonic. And if the fuel equivalent ratio is increased, that tendency is extended to the higher Mach numbers. As the Mach number or the altitude are increased, both the specific impulse and the thrust coefficient ratio, the specific impulse attains the maximum value on the side of lean fuel, the thrust coefficient is increased monotonously. When the total pressure recovery at the air intake is decreased, or the friction coefficient of the combustor wall is increased, both the specific impulse and the thrust coefficient are decreased. This tendency is especially remarkable at high Mach numbers. The performance prediction obtained by this calculation coincided qualitatively quite well with other calculation results and experiment results, and quantitatively fairly well. The result of this calculation is utilized for the flight analysis of space shuttles, the calculation of scramjet engines, and the study of engine systems. 24 refs., 16 figs., 2 tabs.

696 (ORNL-6565) **Transportation energy data book: Edition 10.** Davis, S.C.; Shonka, D.B.; Anderson-Batiste, G.J.; Hu, P.S. Oak Ridge National Lab., TN (USA). Sep 1989. 245p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90000963. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The Transportation Energy Data Book: Edition 10 is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the Office of Transportation Systems in the Department of Energy (DOE). Designed for use as a desk-top reference, the data book represents an assembly and display of statistics and information that characterize transportation activity, and presents data on other factors that influence transportation energy use. The purpose of this document is to present relevant statistical data in the form of tables and graphs. Each of the major transportation modes - highway, air, water, rail, pipeline - is treated in separate chapters or sections. Chapter 1 compares US transportation data with data from seven other countries. Aggregate energy use and energy supply data for all modes are presented in Chapter 2. The highway mode, which accounts for over three-fourths of total transportation energy consumption, is dealt with in Chapter 3. Topics in this chapter include automobiles, trucks, buses, fleet automobiles, federal standards, fuel economies, and household data. The last chapter, Chapter 4, covers each of the nonhighway modes: air, water, pipeline, and rail, respectively. 60 figs., 87 tabs.

697 (PB-89-916304/XAB) **Railroad accident report: Head-on collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with release of hazardous materials near Altoona, Iowa, on July 30, 1988. Irregular report.** National Transportation Safety Board, Washington, DC (USA). Bureau of Accident Investigation. 6 Jul 1989. o (NTSB/RAR-89/04). Available from NTISSubscription.

Paper copy also available on subscription, North American Continent price $85.00/year; all others write for quote.

About 11:40 a.m. central daylight saving time on July 30, 1988, Iowa Interstate Railroad Ltd. (IAIS) freight trains Extra 470 West and Extra 406 East collided head on within the yard limits of Altoona, Iowa, about 10 miles east of Des Moines, Iowa. All 5 locomotive units from both trains; 11 cars of Extra 406 East; and 3 cars, including two tank cars containing denatured alcohol, of Extra 470 West derailed. The denatured alcohol, which was released through the pressure relief valves and the manway domes of the two derailed tank cars, was ignited by the fire resulting from the collision of the locomotives. Both crew members of Extra 470 West were fatally injured; the two crew members of Extra 406 East were only slightly injured. The estimated damage (including lading) as a result of this accident exceeded $1 million. The major safety issues in the accident include operational methods employed by the IAIS, training and selection of train and engine personnel, supervisory oversight by the IAIS, design of closure fittings on hazardous materials rail tanks, and oversight of regional railroads by the Federal Railroad Administration.

3203 Industry and Agriculture

Refer also to citation(s) 61, 181, 697, 730, 736, 770, 1983

698 (CONF-890814-8) **Bio- and photodegradable copolymers derived from low-cost feedstocks.** Coleman, R.D.; Tsai, T.S.; Tsai, S.P.; Bonsignore, P.V. Argonne National Lab., IL (USA). 21 Aug 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineer's summer national meeting; Philadelphia, PA (USA); 20-23 Aug 1989. Order Number DE90001411. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Agricultural and industrial waste streams have become an economic burden as well as a serious environmental problem. In the United States, billions of pounds of cheese-whey permeate and approximately 10 billion pounds of potatoes processed each year are typically discarded or sold as cattle feed at $3-6/ton, sometimes requiring expensive transportation. As a potential solution to this economic and environmental problem, Argonne National Laboratory is developing technology that: bioconverts existing food-processing waste streams into lactic acid, and uses lactic acid to make environmentally safe, degradable plastics. An Argonne process for bioconverting high-carbohydrate food wastes into lactic acid will not only help to solve a waste problem for the food industry, but also will save energy and is economically attractive. This process is briefly discussed. 2 figs.

699 **Kraft recovery boiler physical and chemical processes.** Adams, T.N.; Frederick, W.J. 256p. The American Paper Institute, Inc., New York, NY (1988). Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-88CE40835.

The focus of this book is on the recent research into the physical and chemical processes occurring in and around a black liquor recovery boiler. Almost all of the detailed technical information in this book has previously appeared in the open literature. The purpose here is not to present research for the first time, but to present it in a context of the other processes occurring in recovery boilers. Topics covered include: general characteristics of recovery boilers; black liquor thermal and transport properties; black liquor droplet formation and combustion; recovery boiler char bed processes; flow and mixing in Kraft recovery boilers; entrainment and carryover in recovery furnaces; fume formation and dust chemistry; deposits and boiler plugging; and recovery boiler thermal performance. 257 refs., 102 figs., 38 tabs.

700 (DOE/ID/12422-2) **Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985-September 30, 1987.** Li, N.N.; Funk, E.W.; Chang, Y.A.; Kulkarni, S.S.; Swamikannu, A.X.; White, L.S. Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center. 30 Sep 1987. 116p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-82ID12422. Order Number DE90001600. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report provides an overview of a project with Allied-Signal which focused on developing new membrane technology with potential for energy conservation in the petrochemical industry. Three applications were investigated: (1) bulk removal of polar (sour) gases from natural gas using spiral-wound, cellulose acetate membranes; (2) recovery of solvent from solvent/heavy oil mixtures using polysulfone ultrafiltration membranes; and (3) separation of polar gases (e.g., H_2S and NH_3 from H_2) using mixed-matrix, facilitated-transport membranes. This report summarizes laboratory research results performed in an earlier phase of this project and provides results from pilot-scale, field test studies and economic assessments.

701 (DOE/ID/12553-3) **Separation, fractionation concentration and drying of food products: Addendum report, April 1, 1988-April 30, 1989.** Merlo, C.A.; Rose, W.W.; Pedersen, L.D. National Food Processors Association, Dublin, CA (USA). Aug 1989. 81p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-84ID12553. Order Number DE90001036. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Tomato juice fractions and paste produced in an On-Site Study were subjected to a storage study. The fractions and paste were evaluated initially before storage, made into control and recombined purees, and the purees were evaluated. The purees were similar in viscosity, differed somewhat in color and syneresis. The paste and concentrated serum were stored 3 months at 40, 70, 90°F; the pulp was frozen. After storage, control and recombined purees were made; the purees made from 70°F stored paste or serum were thermally processed. These thermally processed purees were stored 3 months at 40, 70, 90°F. After storage, the recombined purees stored at 70 and 90°F showed a viscosity loss within 0.1–0.3 cm of the viscosity loss of the control purees. 19 refs., 16 figs., 20 tabs.

702 (EEO-ED–32/1) **Waste heat recovery from the absorption stage of a sulphuric acid plant. Demonstration project at Berk Spencer Acids Ltd., London.** Department of Energy, London (UK). Energy Efficiency Office; NIFES Ltd., Buntingford (UK). Dec 1983. 20p. Order Number DE90713721. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Between 1979 and 1983, Berk Spencer Acids achieved energy savings worth over Pound 36,000/year by installing a series of heat exchangers to recover waste heat from the absorption stage of their sulphuric acid plant. The heat recovered was used to pre-heat feedwater both to a waste heat boiler in the sulphur burning section of the plant and, after later modifications, to two oil/gas-fired package boilers on site. This report describes the principles of the scheme and the modifications effected and summarizes the results. Approximately 25% of the total heat generated during sulphuric acid production is liberated during the absorption stage and this had traditionally been discarded to the environment by air and water cooling. The problems associated with heat recovery from the corrosive acid stream were overcome by the inclusion in the system of an intermediate closed-loop water circuit. This circuit, which contains a pH alarm, virtually eliminates the risk of acid contaminating the boiler feedwater system. (author).

703 (EEO-ED–40/98) **Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone].** Leicester, J. Department of Energy, London (UK). Energy Efficiency Office. Mar 1987. 37p. Order Number DE90713734. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

W T Lamb Holdings Ltd have installed a waste heat recovery system on a Scotch kiln complex to use the heat extracted from the kiln exhaust to dry green bricks. The monitoring of this project has shown a 25% energy saving based on total energy or 62.5% based on the drying process alone. This represents a financial saving of Pound 22,710 against a capital cost of Pound 42,500, giving a simple payback period of 1.9 years. The performance of the glass heat exchanger under difficult and corrosive conditions is of a much wider interest to other types of intermittent kilns used by the heavy clay sector of the brick industry and also other industrial sectors where heat recovery from acid-laden and heavily fouled exhaust gases offer a considerable potential for heat recovery. (author).

704 (EEO-ED–75) **Heat recovery and energy saving using a Baker Perkins Simplex 2000 bread baking oven. A demonstration at Mothers Pride Bakery. [Nottingham].** Department of Energy, London (UK). Energy Efficiency Office; Atkins (W.S.) and Partners, Epsom (UK). Feb 1986. 27p. Order Number DE90713733. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The first installation of a new type of British bread oven capable of producing 6,800 loaves/hour has reduced energy costs at British Bakeries' Watnall plant by Pound 45,900/year, including Pound 23,500/year due to the inclusion of heat recovery equipment on the oven. Additional benefits of this new oven include reduced production labour requirements - a reduction of one man per shift due to automatic handling of the bread-tin lids - and an increase in productivity of 100% compared with previous models. The new oven - a Baker Perkins Simplex 2000 - is indirect-fired which means that the burners can use either gas or oil without fear of contamination of the product. A new layout of the burners gives a better heat distribution than in previous models, thus requiring less fuel to achieve a given temperature in each zone. In addition there is heat recovery from both the combustion flue products and the oven chamber exhaust. The prover is heated by means of hot water coils using recovered heat from the oven exhaust. The combustion flue products are used to provide some pre-heating of the combustion air. (author).

705 (EEO-ED–144/140) **Minimising operating costs in continuous fabric washing.** Department of Energy, London (UK). Energy Efficiency Office; Shirley Inst., Manchester (UK). Nov 1988. 29p. Order Number DE90713739. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The installation of measuring and monitoring equipment in continuous washing processes can help reduce energy bills by approximately 10% worth Pound 3,000/year in a typical process. Based on a capital cost of Pound 1,500 the payback period would be approximately 6 months in a typical textile finishing plant. The study described identified two opportunities for saving costs, namely that minimising the fuel and water costs while maintaining the desired level of rinsing, would save 10 to 15% of the total costs in a typical case; and that ensuring that the level of rinsing is set to the minimum consistent with the requirements of the processes following, could save a further 20 to 25% depending on the circumstances. (author).

706 (EEO-ED–147/204) **Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough].** Mercer, A.C. Department of Energy, London (UK). Energy Efficiency Office. Nov 1988. 46p. Order Number DE90713738. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

In 1980, ICI Chemicals and Polymers Group carried out a process integration study on the Aromatics II complex (A II) at its North Tees Works. It identified a number of opportunities for the reduction of energy costs at the plant in addition to those implemented from a previous study. One of the opportunities involved an innovative heat recovery scheme and was financially supported under the Energy Efficiency Demonstration Scheme. This report provides details of the process integration study and the monitored energy cost savings from the plant modifications. (author).

707 (EEO-ED–181/167) **Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds.** Department of Energy, London (UK). Energy Efficiency Office; BNF Metals Technology Centre, Wantage (UK). Feb 1988. 29p. Order Number DE90713736. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The Guiseley Works of Crompton Parkinson Motors Ltd operates a gas-fired Morgan 750 kg immersed crucible furnace. The furnace is used to melt aluminium ingot and scrap for the production, by pressure diecasting, of squirrel cage rotors and conductor bars of AC electric motors. The project comprised the installation of a Nuway MPR15 multiplex waste heat recovery unit and the replacement of a high/low burner control unit with a modulating system. The existing pre-mix gas burner of 2.0 GJ/h was replaced with a 1.58 GJ/h high velocity nozzle-mix burner capable of operating with preheated air. Long-term monitoring has shown that a considerable reduction in energy costs has been realised by the modifications. The weekly energy consumption and the specific energy consumption have been reduced by around 12.5 GJ/week (17%) and 7.5 GJ/tonne (34%) respectively. At a metal throughput rate of around 200 tonnes/year this represents savings of nearly Pound 5,000/year. With a capital installed cost of under Pound 7,000 the simple payback period is less than 18 months. (author).

708 (EEO-ED–189/199) **Copper vapour heat recovery using a spiral heat exchanger. A demonstration at Alloa Brewery Co.** Department of Energy, London (UK). Energy Efficiency Office;

Atkins (W.S.) and Partners, Epsom (UK). Mar 1988. 24p. Order Number DE90713727. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

A system for recovering heat from copper vapours has been demonstrated at the Alloa Brewery Company. It is based on a spiral heat exchanger, capable of recovering 85-90% of the available heat even when non-optimised. At a fuel cost of 24p/therm, this would be worth around Pound 8,800/year. In this installation the recovered heat is used to pre-heat boiler make-up water. The system operates with a fixed water flow through the spiral heat exchanger. As a result the exit water temperature varies between 50°C and 94°C depending on the brew cycle. Should the water flow rate be controlled to maintain a constant high exit temperature the savings achieved would improve. Experience from the Alloa demonstration project suggests that heat recovery from copper vapours can be cost-effective. (author).

709 (EEO-ED–205/188) **Combined heat and power using an aero-derived gas turbine. A demonstration at Smith, Stone and Knight Ltd., Nechells, Birmingham.** Department of Energy, London (UK). Energy Efficiency Office. Feb 1988. 111p. Order Number DE90713726. Available from NTIS (US Sales Only), PC A06/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

During its first 12 months operation, a combined heat and power (CHP) installation at a paper mill achieved energy cost savings which varied between Pound 8,000/week and Pound 16,000/week according to season and fuel price fluctuations. The payback period is between 2.5 and 3.5 years. The main features of the scheme are the use of a gas-turbine-powered generating set to meet the electrical power requirements of the mill, and use of the gas turbine's high temperature exhaust, with the aid of supplementary fuel, to provide heat to a boiler which produces enough steam to meet the requirements of the entire mill site. The net power output of the CHP system is in balance with the mill load and no problems have been experienced with operation in parallel with the Midlands Electricity Board (MEB). Power is exported to, or purchased from, the MEB to balance the process requirements. Opportunities exist for energy saving through similar installations not only in the paper industry but in any continuous process industry where the site electrical load exceeds 2 MW and steam demand is over 7 tonnes/hour. (author).

710 (EEO-ED–223/241) **Energy use comparison between conventional reconstruction and hot-drum mix recycling for major trunk roads. A demonstration by Kent County Council. [Maidstone].** Hubert, P.A. Department of Energy, London (UK). Energy Efficiency Office. Jul 1988. 14p. Order Number DE90713732. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The use of recycled materials in road reconstruction is a well established practice outside of the UK. Here however, where raw materials for roadmaking are plentiful, the energy and cost savings to be gained from the use of recycled materials had not been quantified until recently and its practicality not investigated. Indeed there has been resistance to the widespread adoption of road recycling techniques. The full-scale demonstration by Kent County Council has shown that up to 60% recycled material can be produced in a continuous hot-drum mixer and used effectively in road reconstruction. The project has shown that considerable cost savings can be obtained using these materials. Also from this project has come the recommendation that a mobile plant located on-site, would produce substantial further savings. (author).

711 (EEO-ED–229/317) **Application of combustion air pre-heating to 50t/h water tube boilers. A demonstration at British Sugar plc. [York].** Department of Energy, London (UK). Energy Efficiency Office. Nov 1988. 45p. Order Number DE90713728. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Energy savings worth approximately Pound 63,900 have been achieved by British Sugar plc during the four-month sugar beet processing campaign at their York factory. The company decided to improve the efficiency of the boiler plant at York by retrofitting combustion air pre-heating equipment to both boilers. Although both thermal wheel regenerators and plate heat exchangers were technically acceptable for this application, the company selected AREX plate heat exchangers which would allow the existing combustion air fans to be retained. Final monitoring during the 1987/88 campaign showed that the combustion- air pre-heat system increased boiler efficiency by 3.6% compared with a revised design figure of 3.9%. Energy savings of 22,659 GJ worth Pound 63,898 were achieved during the four months of operation, giving a simple payback period of 3.71 years on the installed cost of Pound 236,980. (author).

712 (EEO-ED–237/174) **Waste heat recovery from a heavily contaminated waste stream. A demonstration at Tioxide UK Ltd. [Hartlepool].** Department of Energy, London (UK). Energy Efficiency Office. Dec 1988. 32p. Order Number DE90713730. Available from NTIS (US Sales Only), PC A03.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The continuous production of titanium dioxide pigment involves a number of individual operations including a surface treatment of the white pigment particulates. This is carried out in steam driven fluid energy mills and gives rise to an exhaust at high temperature of steam, air and particulates. Substantial potential benefits from heat recovery from the fluid energy mill exhaust have been identified. However, conventional heat recovery from this heat source was considered impractical due to the likelihood of fouling of the heat transfer surfaces. The approach adopted involved a novel means of heat recovery. A spray condenser arrangement was used where water (or dilute pigment slurry) was injected into the fluid energy mill exhaust. This condenses a portion of the steam and produces a dilute water/pigment slurry at 90°C. This slurry is then pumped around a number of operations where the recovered heat is utilised, currently to preheat: the boiler feedwater; the boiler air; the spray dryer inlet air; and process water. The system was fully commissioned in 1986, and independent monitoring has shown that the scheme is successful, both technically and economically. (author).

713 (EEO-ED–238/229) **Use of stand-by generators for combined heat and power. A demonstration at Perkin Elmer Ltd. [Llantrisant].** Department of Energy, London (UK). Energy Efficiency Office; FEC Consultants Ltd., Oldham (UK). Mar 1989. 56p. Order Number DE90713725. Available from NTIS (US Sales Only), PC A04/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

The standby power generation facilities, installed to protect a factory against failure of the mains electricity supply, have been converted to Combined Heat and Power (CHP). Independent monitoring of the project, over a period of two years, has clearly established that: Electricity can be cost effectively generated for about 2.4p/kW h; after 'normalisation' average savings of Pound 25,600/a have been achieved; with current conversion costs, a simple payback of 2.5 years would result; other sites could benefit from the application of the technology. The aforementioned savings figures do not take into account any benefit from reducing the losses which might result from mains failure and which it is claimed can be as high as Pound 3,600/h. Experience to-date has shown that the converted units have reduced the consequences of the mains failures which have occurred since the units were converted to CHP. Whilst the concept of CHP was well established, the use of standby generators for such purposes was new and unproven: conversion to CHP entails recovering the otherwise wasted engine and exhaust heat by the addition of heat exchangers and modifying the control system to enable the units to operate on a sustained basis and in parallel with the mains electricity supply. (author).

714 (EEO-ED–240/270) **Foundry ladle preheater of improved design. A demonstration at North British Steel Group Ltd. [Bathgate].** Department of Energy, London (UK). Energy Efficiency Office; British Steel Corp., Rotherham (UK). Swinden Labs. Jan 1989. 25p. Order Number DE90713724. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

Foundry ladle preheaters have tended to be simple or even crude pieces of equipment, with correspondingly low performances and thermal efficiencies. The host company was encountering difficulties on account of inadequate preheat temperatures, and also had noted that ladle preheating was a significant element of the foundry's energy demand. Therefore, a decision was taken to adapt the technology used for preheating steelworks ladles of several hundred tonnes capacity to ladles of 5-7 tonnes capacity, with the objective of attaining similar preheat temperatures and thermal efficiencies on much smaller scale plant. A pair of ladle preheating stations were installed and commissioned at a total cost of Pound 17,627. Installation, commissioning and operation have all been substantially trouble free, and savings have been obtained from: ladle preheaters worth Pound 9,600/year; a reduction in tapping temperature of the melting furnace worth Pound 2,570/year; a reduction in yield losses worth Pound 3,200/year; and improved ladle lining life worth Pound 400/year. Overall savings attained were Pound 15,770/year, giving a payback period of 1.1 years. (author).

715 (EEO-ED–245/208) **Combined heat and power in a grain whisky distillery. A demonstration at Scottish Grain Distilleries Ltd., Port Dundas, Glasgow.** Department of Energy, London (UK). Energy Efficiency Office. Mar 1989. 50p. Order Number DE90713723. Available from NTIS (US Sales Only), PC A03.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

A gas turbine based CHP system installed at a whisky distillery has been in beneficial operation since September 1985. It provides a surplus of electrical power and a supply of high grade energy in its exhaust gas, used directly in a dryer associated with the by-product animal feed plant, as well as for process steam generation. The main features of the system are the direct use of some of the hot exhaust gas from a 5.9 MWe industrial gas turbine generator as the heat supply for a pneumatic dryer, with the remaining gas used for steam generation in a waste heat boiler. The generator operates in parallel with the South of Scotland Electricity Board (SSEB) supply, regularly exporting up to 3 MWe to the grid. The total cost of the system excluding the cost of the dryer was Pound 2.3 million before grant assistance. On the basis of the current 5,000 annual distillery operating hours, the estimated operating cost benefit amounts to some Pound 442,000/year in comparison with purchased electricity, gas fired boilers and a fired dryer, giving a simple payback period of 5.2 years, exclusive of capital grants. (author).

716 (ORNL/Sub–87-SB064/1) **Development of ice self-release mechanisms: Final report.** Stewart, W.E. Jr. Oak Ridge National Lab., TN (USA); Missouri Univ., Independence, MO (USA). Energy Research Lab. Sep 1989. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90000980. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study reports the results of a series of experiments that investigated a thermal storage technology whereby slush ice is grown on a submerged cold surface, and the resultant growth of slush ice releases without auxiliary thermal or mechanical means. The process investigated consists of growing slush ice from an electrolyte solution of low molarity. The cold surface (substrate) upon which the slush ice forms is submerged in the bulk solution. As the buoyancy force on the ice crystals exceeds the adhesion of the slush ice to the cold surface, the slush ice is forced from the substrate and floats away to the top of the solution. The results of this study reveal the relative insensitivity of the growth rate of ice crystals to solution initial bulk concentration over the range of values tested and to concentration of electrolyte during accumulation of ice crystals. The critical parameter appears to be substrate temperature, which cannot be less than ~2°C below the freezing point temperature of the solution, because apparent adhesion increases rapidly with decreasing substrate temperature. 1 ref., 6 figs., 7 tabs.

717 (PB–89-213433/XAB) **Recycling grants in Illinois: A two year review. Final report.** Lindsey, G.; Lechner, L.; Webb, M. Illinois Association of Recycling Centers, Naperville, IL (USA). May 1989. 123p. Available from NTIS, PC A06/MF A01.

This report reviews of the 1985 and 1986 Illinois Recycling Grants Programs. The study was undertaken to develop information that can be used by state decision makers in administration of future cycles of the grants program, and by recycling managers to improve the quality of planning for recycling programs. The project involved collection of information about recycling grants programs in other states, collection and analysis of operational data from recipients of recycling grants, and assessment of whether recipients have been successful in meeting objectives. Findings are summarized.

718 (PB–89-216667/XAB) **Gallium arsenide recycle chemistry and metallurgy.** Bartlett, R.W. Bartlett Technologies, Idaho Falls, ID (USA). 23 Mar 1987. 23p. Available from NTIS, PC A03/MF A01.

Research was successfully conducted on a smelting approach to separate gallium from arsenic using a liquid copper alloy to collect arsenic while oxidizing the gallium into a soda-silica slag. The slag and copper form two immiscible liquid phases. With GaAs in powder form, smelting at 1150 to 1220°C yields 98% of the gallium in the slag and at least 96% of the arsenic in the copper. The gallium concentration in this slag is, relative to other sources, very high, and it can be processed further to obtain crude gallium. The effect of chemical oxidizers on arsenic and gallium distribution between slag and copper was determined. The solidified copper-arsenic alloy is environmentally inert. However, any precious metals present with the electronic scrap will nearly completely collect in the copper. Commercial copper refineries are capable of recovering precious metals from the copper-arsenic alloy, and are equipped to handle large amounts of arsenic when compared with the amount of arsenic used in GaAs devices, even with many fold future expansions.

719 (PB–89-217988/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 54p. Available from NTIS, PC A04/MF A01.

The Resource Conservation and Recovery Act (RCRA) Handbook was developed for vehicle and heavy-equipment maintenance businesses to assist them in complying with pertinent sections of the requirements. It provides procedures to minimize the costs of complying with the RCRA requirements by minimizing waste quantities and by focusing the facility manager's attention on those parts of the RCRA regulations that are relevant to normal operations at vehicle-maintenance facilities. It also identifies special Montana regulations applicable to vehicle maintenance facilities. Various sections of the manual include: description of facility operations and the wastes generated as a result of their operations; a discussion of hazardous wastes generated and the RCRA regulations that specifically apply to them; RCRA generator requirements; and hazardous and non-hazardous waste-management strategies. The appendices provide: information regarding the acute and toxic commercial chemical products and wastes (f, p, and u wastes); procedures for identifying characteristic hazardous wastes in vehicle-maintenance facilities; and a list of references and contacts for obtaining additional information about hazardous wastes and their regulation.

720 (PB–89-219968/XAB) **Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989.** Hummel, K.E.; Nelson, T.P. Radian Corp., Austin, TX (USA). Jul 1989. 98p. Available from NTIS, PC A05/MF A01.

This report gives recommendations of a multidisciplinary panel of experts on new or novel technologies (or modifications of existing technologies) which show the most promise for the collection and destruction of chlorofluorocarbons and related compounds. Panel members met in a 'roundtable' format to discuss their experiences and relate them to the compounds of interest. The panel identified technologies holding the most promise and suggested general areas of research and development needed to develop collection and destruction technologies.

721 (PB–89-220487/XAB) **Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments.** Apel, M.L.; Freeman, H.M.; Szabo, M.F.; Ambekar, S.H. PEI Associates, Inc.,

Cincinnati, OH (USA). Aug 1989. 43p. Available from NTIS, PC A03/MF A01.

The guidance document provides an overview of a new research demonstration program designed to evaluate the use of innovative engineering and scientific technologies to reduce the volume and/or toxicity of wastes produced from the manufacture, processing, and use of materials. The 'WRITE Pilot Program With State and Local Governments' is a major component of a national pollution-prevention research program called the 'Waste Reduction Innovative Technology Evaluation' (WRITE) Program. The WRITE program is broad in technical scope and addresses the reduction of pollutants across all environmental media: air, land, surface water, and ground water. Under this pilot program, technical and economic evaluations of source reduction and recycling technologies are being conducted through the joint efforts of various State and local governments and the Environmental Protection Agency. Information obtained under this program will assist Federal, State, and Local Governments as well as small and mid-size industries in evaluating waste-reduction technologies by providing reliable performance and cost information on pollution-prevention technologies. The research will also serve to accomplish an early introduction of waste reduction techniques into broad commercial practice.

722 (PB–89-222301/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Pesticide application.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 46p. Available from NTIS, PC A03/MF A01.

This RCRA Handbook was developed for pesticide applicators to provide assistance in complying with pertinent sections of the RCRA requirements. Section 2 summarizes operations of pesticide users and describes potential waste types that could be generated from these operations. Section 3 provides a guide for determining if a particular pesticide waste is subject to these regulations. Section 4 discusses the RCRA generator requirements, while Section 5 describes waste-management strategies for minimizing the amount of hazardous waste generated by the pesticide applicators. Appendix A lists hazardous wastes. Appendix B summarizes RCRA characteristic wastes. Appendix C contains a list of references and contacts for obtaining more information about hazardous wastes and their regulation.

723 (PB–89-224091/XAB) **Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report.** Nunno, T.; Palmer, S.; Arienti, M.; Breton, M. Alliance Technologies Corp., Bedford, MA (USA). Oct 1986. 177p. Available from NTIS, PC A09/MF A01.

This document contains case studies focusing on solvents and metals waste streams from the metal-plating and printed-circuit-board industries. Specific waste streams studied include waste solvents from resist stripping and developing operations, and plating baths and waste sludges from plating operations. The case studies include a discussion of the process operations, waste streams, mass throughputs, economics of the technology, and process residuals.

724 (PB–89-224760/XAB) **Hazardous-waste-reduction guidelines for environmental-health programs.** Hanlon, D.; Determan, D. Ventura County Environmental Health Dept., CA (USA). May 1987. 74p. Available from NTIS, PC A04/MF A01.

The guidelines are part of a two-year program in Ventura County that resulted in a 70% reduction of the volume of hazardous waste going on land disposal. The program demonstrates that local government can directly promote waste reduction without hindering established hazardous-waste-program efforts. The guidelines offer a variety of waste-minimization components that can be developed in conjunction with new and expanded hazardous materials programs. These guidelines were developed to assist local governments achieve hazardous waste minimization objectives by utilizing the resources of existing hazardous waste programs.

725 (PB–89-869549/XAB) **Ion-exchange resins. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 91p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868500.

This bibliography contains citations concerning preparation, regeneration, and applications of ion exchange resins. Applications include water and waste treatment; food processing; chemical recovery, separation, purification, and catalysis; desalination; and ore treatment and recovery. Methods are included for the processing of spent ion exchange resins and for protecting ion-exchange resins from oxidation and chemical degradation. (This updated bibliography contains 238 citations, 11 of which are new entries to the previous edition.)

726 (PB–89-869622/XAB) **Recycling plastic scrap: injection molding. January 1973-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 61p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867718.

This bibliography contains citations concerning the recycling of scrap plastic produced in the injection-molding process. Plastic pellets made from scrap that are used in the injection-molding process are also discussed. Recycling equipment and automated recycling systems are described. Ways to utilize plastic scrap from used cars, packaging materials, and waste from polyurethane production are presented. (This updated bibliography contains 116 citations, 14 of which are new entries to the previous edition.)

727 (UCRL–101995) **Water spray mitigation of hydrofluoric acid releases.** Schatz, K.W.; Koopman, R.P. Lawrence Livermore National Lab., CA (USA). Sep 1989. 52p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908168–1: AIChE meeting on controls of accidental releases of hazardous gases, Philadelphia, PA (USA), Aug 1989). Order Number DE90002107. Available from NTIS, PC A04/MF A01 - OSTI.

Two series of tests were conducted in flow chambers to assess the effectiveness of water spray in mitigating releases of Hydrogen Fluoride (HF). Bench scale experiments identified key variables for testing in a larger facility. The larger scale field tests have demonstrated that HF releases can be mitigated with water and have also quantified the impact of numerous design variables on mitigation effectiveness. HF removal efficiencies of 25 to 90+% have been demonstrated at water to HF liquid ratios of 6/1 to 40/1. 81 refs., 18 figs., 1 tab.

728 **A cost-effective and fuel-conserving nonelectric air conditioner that combines engine-driven compression and absorption cycles.** Wicks, F. *Transactions of the American Nuclear Society (USA),* 57: 209-211 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A natural-gas-fueled electricity-producing condensing furnace with the potential of being mass produced at a cost of less than $1000 and providing a cost-effective and highly fuel-conserving alternative to virtually every residential gas furnace in the world has been developed. While this is a new system, it completely consists of existing mass-produced components including single-cylinder air-cooled engines, induction motors/generators, and control devices. Thus, timely commercialization can be expected and an important new energy technology and industry can result. However, all the benefits of this electricity-producing furnace occur during the winter. This has stimulated the search for a new system that can provide comparable benefits in terms of fuel conservation, the environment, and electric utility peak reduction during the summer, along with the prospects of a new and efficient new use for the natural gas surpluses that occur during the summer. The resulting system, which can use existing component equipment, is a commercial-size nonelectric air conditioner that consists of an automobile-type engine converted to natural gas, or possibly a diesel or combustion turbine, driving a Freon compression cycle, with virtually all of the engine reject heat from the exhaust and from the engine cooling system driving a conventional absorption air conditioning cycle.

729 **Corrosive resistant heat exchanger.** Richlen, S.L. To Dept. of Energy, Washington, DC. USA Patent 4,840,226. 27 Jun

1989. Filed date 10 Aug 1987. Int. Cl. F28F 19/00. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A corrosive and errosive resistant heat exchange is described which recovers heat from a contaminated heat stream. The heat exchanger utilizes a boundary layer of innocuous gas, which is continuously replenished, to protect the heat exchanger surface from the hot contaminated gas. The innocuous gas is conveyed through ducts or perforations in the heat exchanger wall. Heat from the heat stream is transferred by radiation to the heat exchanger wall. Heat is removed from the outer heat exchanger wall by a heat recovery medium.

3206 Municipalities and Community Systems

Refer also to citation(s) 25, 231, 590, 593, 594, 599, 600, 601, 602, 629, 630, 652, 717, 720, 722, 724, 725, 1081, 1317

730 (AD-A-209617/0/XAB) **Hazardous-waste technical-assistance survey, Carswell AFB, Texas. Final report, 16-27 May 1988.** Ng, E.K.; Hedgecock, N.S. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Mar 1989. 71p. (USAFOEHL-89-020EQ0032CHH). Available from NTIS, PC A04/MF A01.

The USAFOEHL conducted a hazardous-waste technical-assistance survey at Carswell AFB (CAFB), Texas, from 16-27 May 88 to address hazardous-waste-management practices, establish a waste sampling strategy, and explore opportunities for hazardous-waste minimization. The survey team performed a shop-by-shop evaluation of chemical-waste management practices and met with hazardous-waste managers and engineers to discuss the hazardous-waste program. Survey results showed that CAFB needs to formalize the hazardous-waste management program. Recommendations include: (1) develop a waste analysis plan to include a complete listing of all waste streams, the results of a baseline waste analysis, the analytical parameters, the test and sampling methods, and the sampling frequency for each waste-stream; (2) instigate an education and training program to support a formalized hazardous-waste management program and to strengthen communication between managers and shop personnel; (3) leak test the underground tank at the Auto Hobby Shop; (4) contact the Fort Worth waste water treatment plant to discuss the possibility of approving the disposal of waste antifreeze in the sanitary sewer system; (5) consolidate existing work orders to upgrade accumulation sites; (6) consider alternate solvents to minimize waste PD-680; (7) provide the Environmental Coordination with access to a government vehicle to facilitate more-frequent inspections of accumulation sites located in controlled areas; and (8) collect hazardous-waste samples from drums using disposal coliwasas rather than a reusable coliwasa.

731 (BNL-42593) **Economical disposal of municipal solid waste with minimal discharges to the atmosphere and maximum recycling of energy and metal values.** Grohse, E.W.; Steinberg, M.; Koppel, P.E. Brookhaven National Lab., Upton, NY (USA). Mar 1989. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-76CH00016. (CONF-890422-3: International conference on municipal waste combustion, Hollywood, FL (USA), 11-14 Apr 1989). Order Number DE90000530. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A process has been developed at Brookhaven National Laboratory for the disposal of municipal solid wastes with minimal discharges to the atmosphere and maximum recycling of the energy and metal values contained therein. The energy values are recovered as zero ash, zero sulfur, zero nitrogen, zero chlorine particulate carbon (carbon black) fuels and a hydrogen-rich (or methane-rich) gaseous co-product. The process is especially adaptable to the disposal of plastic wastes and recycling of its energy values. Also, the inclusion of medical wastes should be no problem. The process consists of hydrogasifying prepared MSW (or any carbonaceous feedstock) to form a methane-rich process gas, which is then thermally decomposed (cracked) to form the primary product, carbon black, and hydrogen which is recycled to the hydrogasifier. Oxygen in the MSW is presently removed as water from the hydrogasifier effluent before it enters the methane decomposer. Any remaining hydrogen in the MSW feed is ultimately removed from the process as a co-product gas as hydrogen per se and/or methane (SNG). Chlorine in feed containing PVCs, for example, is removed as relatively minute amounts of hydrogen chloride in the condensed water discharged from the recuperative partial condenser. Desulfurization is not required to produce sulfur-free carbon black per se. Various options are available for desulfurization of the co-product gas. Since the process operates under a highly-reducing hydrogen atmosphere, toxic oxygenated compounds such as dioxins cannot form and metals entering with the MSW are removed with the "ash" as metals, not oxides.

732 (ORNL/M-966) **Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final.** Chidambariah, Venkatesh; Garrett, J.K.; King, K.H.; Yambert, M.W.; Travis, C.C. Oak Ridge National Lab., TN (USA). 29 Sep 1989. 96p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90001287. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Environmental Protection Department of the US Department of Energy Kansas City Plant (DOE/KCP) requested that a risk assessment be performed on the potential health effects of discharges of polychlorinated biphenyls (PCBs) from the DOE/KCP to the Blue River Sewage Treatment Plant, Kansas City's largest publicly owned treatment works facility (Kansas City POTW). The major objectives of this risk assessment are (1) to determine the potential health impacts of DOE/KCP's current discharges of PCBs to the Kansas City POTW via all reasonable exposure pathways and (2) to determine a health-based, "safe" discharge level for PCBs to the Kansas City POTW. The present risk assessment considers both occupational and public impacts of PCB discharges from the DOE/KCP. Two occupational exposure scenarios assessed are (1) risk to Kansas City POTW sewer line maintenance workers and (2) risk to Kansas City POTW workers during routine operations of the facility. Both types of workers may be dermally exposed to PCBs in sewage. Public risks considered include risk to populations living within 50 km of the Kansas City POTW via inhalation of PCBs from sludge incinerated at the facility. Additionally, risk to the general public associated with PCB releases from the Kansas City POTW to the Missouri River is assessed. These pathways include ingestion of PCBs in drinking water supplied by the Missouri River, dermal adsorption and accidental ingestion of PCBs while swimming in the Missouri River, and ingestion of PCBs through consumption of fish taken from the Missouri River. Risk to breastfed infants from ingestion of PCBs through mothers' milk is also assessed. 108 refs., 3 figs., 5 tabs.

733 (PB-89-179030/XAB) **Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report.** Bassi, J. Versar, Inc., Springfield, VA (USA). 31 Jan 1989. 301p. Available from NTIS, PC A14/MF A01.

See also Volume 1, PB-89-179022.

This document provides Appendices to Volume I of the same title. Appendices include: facility profiles; list of commercial facilities not included in SARA Capacity Data Base; Biennial Report Process Codes; System Classification Hierarchy with Translation from Treatment, Storage, Disposal, and Recycling(TSDR) Survey and Biennial Report Codes to SARA Management Categories; Translation from TSDR Survey to Biennial Report for Permit Status and Commercial Status Codes.

734 (PB-89-212286/XAB) **Role of landfill disposal in municipal solid-waste management. Technical report (Final).** Cook, E. Texas A and M Univ., College Station, TX (USA). Dept. of Civil Engineering. Jun 1989. 68p. Available from NTIS, PC A04/MF A01.

See also PB-86-160850.

Despite the current shortage of landfill capacity in densely populated areas of the nation, the relatively low cost of landfill disposal and relatively high human health risk of refuse incineration indicate that landfilling will continue to be the predominant method of refuse disposal. To control ground-water contamination at municipal landfills, the EPA has proposed new Subtitle D regulations (Resource Conservation and Recovery Act, 1984). Those regulations are premised upon effective leachate control, achieved through utilization of low-permeability liners and covers. However, recent research indicates that clay and/or synthetic liners may not prevent leakage of some trace organic compounds in MSW leachate. Furthermore, low-permeability covers prevent rapid biological stabilization of

refuse, prolonging the liability of landfill owners and operators in addition to delaying return of land to productive use. The report evaluates the feasibility of alternative landfill technologies including on-site and in-situ biological-treatment systems and permeable-liner systems. The least expensive and most-manageable treatment system would couple in-situ biodegradation with a permeable attenuation layer and secondary aerobic treatment.

735 (PB–89-218168/XAB) **Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options.** Bruins, R.J.F.; Fradkin, L.; Stara, J.F. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. 1989. 7p. (EPA–600/D-89/016). Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of the National Conference on Municipal Sewage Treatment Plant Sludge Management, Series No. 17, Hazardous Materials Control Research Institute, Silver Spring, MD, 21-24(1987).

Risk-assessment methods have been developed that can be used to calculate criteria for controlling toxic pollutants in municipal waste-water sludges. These methods consist of algorithms, ranging from simple to complex, which allow calculation of exposure and risk from various sludge-disposal practices. These calculations may show a need for management-practice controls or for numerical limits on specific pollutants. Criteria for land-applied or distributed and marketed sludge may take the form of application-rate limits (kg/ha) or concentration limits, calculated to control pollutant levels in the food chain or off-site movement in air or water. Criteria for landfilled sludge are defined in terms of acceptable leachate concentrations, as determined by an appropriate leachate characterization test, to prevent excessive ground-water contamination of vapor emission.

736 (PB–89-218267/XAB) **Transient phenomena in rotary-kiln incineration.** Linak, W.P.; Kilgroe, J.D.; McSorley, J.A.; Wendt, J.O.L.; Dunn, J.E. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 26p. (EPA–600/D-89/026). Available from NTIS, PC A03/MF A01.

This paper describes results of an ongoing experimental investigation at the U.S. EPA into the waste properties and kiln parameters that determine both the instantaneous intensity and the total magnitude of transient puffs leaving the kiln. (NOTE: The batch introduction of waste-filled drums or containers into practical rotary-kiln incinerators can lead to transient overcharging conditions which, for brevity, are here denoted as 'puffs.') The experimental apparatus utilized was a 73-kW laboratory rotary-kiln simulator. Surrogate solid wastes (plastic rods) and surrogate liquid wastes (on corncob sorbent in cardboard containers) were investigated. A statistically designed parametric study was used to determine the extent to which waste and kiln variables (e.g., charge mass, charge surface area, charge composition, kiln temperature, and kiln rotation speed) affected the intensity (hydrocarbon peak height) and magnitude (hydrocarbon peak area) of puffs.

737 (PB–89-221394/XAB) **Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs.** Greathouse, D.; Clements, J. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 12p. (EPA–600/D-89/038). Available from NTIS, PC A03/MF A01.

The paper discusses what expert systems are, the benefits of expert systems, development techniques, example hazardous-waste systems, and considerations that should be evaluated for future systems within the municipal solid-waste sector.

738 (PB–89-223291/XAB) **Technologies for reducing dioxin in the manufacture of bleached wood pulp. Background paper.** Office of Technology Assessment (U.S. Congress), Washington, DC (USA). May 1989. 79p. (OTA-BP-O–54). Available from NTIS, PC A05/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card No. 89-600719.

Alternative technologies using oxygen as a pretreatment to chlorine bleaching and improved delignification that removes more of the potential reactants from the wood can reduce the amount of dioxin in bleached pulp. Substituting other bleaching chemicals for chlorine also shows promise for reducing the amount of dioxin produced in the bleaching process should regulation be required. The study provides an assessment of these technologies; it does not address the policy issues related to regulating dioxin in paper products and controlling environmental release.

739 (PB–89-230668/XAB) **Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final).** Garg, S. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. Nov 1988. 328p. (EPA–530/SW-89/067). Available from NTIS, PC A15/MF A01.

The EPA's Office of Solid Waste is developing amendments to regulations for hazardous-waste incinerators. OSW is gathering additional data relative to these amendments. Several issues arose during development of the amended regulations that required this data gathering. The issues related to control device efficiency for particulate and toxic metals and to the use of total hydrocarbon monitors to measure organic emissions. This report describes the field tests at a hazardous-waste incinerator that is part of this data-gathering effort. The types of data collected during this test are particulate emissions, particle size, selected toxic-metals emissions and their control device efficiency, and organic emissions.

740 **Municipal waste disposal crisis. Hearings before the Subcommittee on Transportation, Tourism, and Hazardous Materials of the Committee on Energy and Commerce, House of Representatives, One hundredth Congress, First Session, March 19, May 6, and June 5, 1989.** Serial No. 100-38. 404p. Government Printing Office, Washington, DC (US) (1987).

Members of Congress and other government officials were among those testifying at a hearing to discuss the problems involved in municipal waste disposal. According to a number of studies the municipal solid waste problem in this country is growing rapidly. As of 1985, we as a nation were generating nearly 200 million tons of municipal waste each year, and this figure is growing at an estimated rate of between 25 and 75 million tons per year. Cities across the country are now struggling with many issues relating to municipal waste disposal. One of the key issues is the safe disposal of municipal incinerator ash. The toxicity of the ashes, particularly the fly ash has been acknowledged under certain circumstances by EPA. An attempt should be made to concentrate on finding treatment solutions that will detoxify residues which are determined to be toxic.

3209 Education and Public Relations

Refer also to citation(s) 1328, 1329

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

Refer also to citation(s) 695

3301 Internal Combustion Engines

Refer also to citation(s) 743

741 (FDS–201/1988) **Calculation of steady and transient torsional vibrations of marine diesels of different system configurations and geometry.** Mahrenholtz, O.; Toedter, J.; Geisler, O.; Nguyen, T.; Reso, H. Forschungszentrum des Deutschen Schiffbaus e.V., Hamburg (Germany, F.R.). 1988. 148p. (In German). Available from Copy held by UB/TIB Hannover.

In recent years the importance of determining the vibrations of machine sets has increased. For propulsion, particularly, the evaluation of torsional vibrations stimulated by reciprocating machines, electric motors and propellers is of great significance. A computer program for the calculation of torsional vibrations has been developed. In this program, the dynamical behaviour of discrete torsional systems is described by different types of elements and loads for nearly any configuration. The program can be used for the design of marine propulsion as well as for that of car propulsion, turbine sets or propulsion of experimental plants. The possibility to change easily the system parameters makes it also available for parameter

studies. The pre-stress of the system can be determined for the calculation of stationary working conditions. The complex eigenvalues and the characteristic vectors are calculated and the eigenmodes are shown. The differential equation system obtained by the modal transformation is integrated and the time dependent results are plotted. For testing the package, the torsional vibration measurements at two different marine propulsion plants, i.e. a plant with elastic coupling and a plant with fluid coupling, are carried out. (orig./HW).

3302 External Combustion Engines

742 (N–89-24593) **On the dynamic response of pressure transmission lines in the research of helium-charged free piston Stirling engines.** Miller, E.L.; Dudenhoefer, J.E. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 8p. (NASA-TM–102121;E–4902;NAS–1.15:102121;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

In free piston Stirling engine research the integrity of both amplitude and phase of the dynamic pressure measurements is critical to the characterization of cycle dynamics and thermodynamics. It is therefore necessary to appreciate all possible sources of signal distortion when designing pressure measurement systems for this type of research. The signal distortion inherent to pressure transmission lines is discussed. Based on results from classical analysis, guidelines are formulated to describe the dynamic response properties of a volume-terminated transmission tube for applications involving helium-charged free piston Stirling engines. The scope and limitations of the dynamic response analysis are considered.

3306 Vehicle Design Factors

743 (SAND–89-2222C) **A laboratory test for fuel injector deposit studies.** Sandia National Labs., Albuquerque, NM (USA). 1989. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909219–1: Society of Automotive Engineers (SAE) international fuels and lubricants meeting, Baltimore, MD (USA), 25-28 Sep 1989). Order Number DE90000802. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A Port Fuel Injector Deposit (PFID) test has been developed which provides repeatable results. The test can discriminate gasolines with differing fuel injector fouling tendencies in vehicles. Results confirm previous work that added mono- and diolefins increase deposit growth. The test is also able to evaluate the performance of additives. Other factors found to affect injector deposit formation include: injector soak temperature, injector soak pressure, weeping vs. non-weeping injectors, and the presence of oxygen around the injector pintle. The PFID test can be run in about one quarter the time needed to evaluate fuels in vehicle and dynamometer tests. 10 refs., 22 figs.

3307 Emission Control

Refer also to citation(s) 746

744 (PB–89-866255/XAB) **Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations from the NTIS data base). Report for September 1979-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 151p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning motor-vehicle applications for certification by the Environmental Protection Agency. The manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. Information on emission-test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing is also provided. Results of emission testing, a statement of compliance with the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of Certificate of Conformity is based are included. (Contains 328 citations fully indexed and including a title list.)

3308 Alternative Fuels

Refer also to citation(s) 596, 597, 598, 599, 600, 601, 628

745 (CONF-8909219–2) **A comparative analysis of alternative fuel infrastructure requirements.** Singh, M.K. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-31109-ENG-38. From Society of Automotive Engineers (SAE) international fuels and lubricants meeting; Baltimore, MD (USA); 25-28 Sep 1989. Order Number DE90001765. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents results of an assessment that identifies vehicle technology and fuel distribution system changes and costs associated with providing sufficient alternative fuels to displace one million barrels/day petroleum in the transportation sector in the 1995–2005 timeframe. The paper concludes that the capital cost of developing fuel delivery systems and a sufficient number of vehicles to achieve this displacement will be $22 billion if the alternative fuel is methanol, $36 billion if natural gas, and $228 billion if electricity. The predominant component of these costs is that of the incremental cost of the vehicles. 10 refs., 3 figs., 8 tabs.

746 (PB–89-214225/XAB) **Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final).** Keating, T. North Carolina Univ., Chapel Hill, NC (USA). Dept. of Environmental Sciences and Engineering. May 1989. 480p. Available from NTIS, PC A21/MF A01.

The study is part of the National Network for Environmental Management Studies conducted under the auspices of the Office of Cooperative Environmental Management–U.S. Environmental Protection Agency. The study is an evaluation of the ability of state-of-the-art photochemical mechanisms to assess the impacts of methanol-fueled vehicles on ambient levels of ozone, formaldehyde, and peroxyacetylnitrate. The evaluation involves comparing the predictions of the California Institute of Technology Mechanism, Carbon Bond Mechanism IV, and the Carter-Atkinson-Lurmann Mechanism to observations from a series of smog-chamber experiments previously conducted at the University of North Carolina. The evaluation demonstrates that the performance of the mechanisms decreases with increasing reactivity of the background mixture of ambient hydrocarbons.

747 **Alternative Motor Fuels Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 16, 1988.** Report 100-929. 21p. Government Printing Office, Washington, DC (US) (1988).

This conference report recommends that the Senate recede from its disagreement to the House amendment to S.1518 and agree to the insertion of this committee's amendment. The purpose of the modified version would encourage the development and widespread use of methanol, ethanol, and natural gas as transportation fuels and the production of new motor vehicles powered by these three alternative fuels. Issues discussed are amendments to the Energy Policy and Conservation Act, use of nonstandard fuels, amendment to the Motor Vehicle Information and Cost Savings Act, electric vehicles, automobile labeling, and study on residential energy pricing.

748 **S. 2720: A bill requiring the use by the Federal Government of certain vehicles capable of operating on alcohol or natural gas fuels or on electricity in areas not in compliance with the Clean Air Act, and for other purposes. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, August 10, 1988.** 11p. Government Printing Office, Washington, DC (US) (1988).

S.2720 regulates any fleet of automobiles or light-duty trucks owned or leased by the US for operation in any area designated under the Clean Air Act as an area of serious or severe health endangerment for ozone or carbon monoxide. As of September 30, 1993, 10% of such vehicles are required to be alternative fuel vehicles. The percentage increases 10% each year until September 30,

2001, at which time 100% of such vehicles should be alternative fuel vehicles. The bill provides extra funding for the purchase of alternative fuel vehicles as needed, but will pay only the portion of the cost which exceeds the cost of comparable conventionally fueled vehicles. The bill also requires gasoline-powered vehicles in the designated areas to be supplied with fuel which blends oxygenates with the gasoline at its primary fueling facility, as of March 31, 1989.

35 ARMS CONTROL

3501 Policy, Negotiations, and Legislation

749 (AD-A–209674/1/XAB) **Force structure implications of START. Study project.** Feldmayer, C.F. Army War Coll., Carlisle Barracks, PA (USA). 31 Mar 1989. 39p. Available from NTIS, PC A03/MF A01.

The emerging Strategic Arms Reduction Talks Treaty (START) will reduce strategic nuclear weapons from 30-50%. The treaty will modify Soviet and American capabilities, but it will not eliminate the nuclear potential for either of the superpowers. START and arms control in general is not a panacea to remedy East-West relations; rather, arms control is one element supporting a nation's strategy and helps to define its strategic position. The primary purpose of arms control is to reduce risks and to maintain strategic stability. Strategy and arms control must be coordinated and we often link arms control proposals to force modernization plans.

3502 Proliferation

750 (AD-A–209811/9/XAB) **Soviet reactions to follow-on-to-Lance (FOTL). Study project.** Wightman, R.O. Army War Coll., Carlisle Barracks, PA (USA). 26 Mar 1989. 56p. Available from NTIS, PC A04/MF A01.

One of the most controversial areas of US military planning for the 1990s is Battlefield Nuclear Weapons (BNW) modernization. The current dilemma has been created in part by Soviet 'public relations' activities in the area of troop reduction and arms control at a time when NATO must decide whether to modernize nuclear weapon systems currently deployed in Western Europe. This paper focuses on the FOTL, which will modernize the soon-to-be-obsolete Lance system. It identifies why NATO needs the new system, why the Soviets want to prevent its deployment, and how the political environment in Western Europe and the US will impact the decision for or against development. The paper also discusses the Soviet frame of reference for reacting to US/NATO initiatives ideology, insecurity, and the correlation of forces. It describes past Soviet reactions to nuclear weapons modernizations (Pershing IIs, Ground Launched Cruise Missiles, and Enhanced Radiation Weapons), and then postulates how the Soviets may respond politically and militarily to a FOTL deployment.

36 MATERIALS

Refer also to citation(s) 939

3601 Metals and Alloys

Refer also to citation(s) 113, 160, 176, 298, 300, 305, 351, 357, 382, 383, 384, 392, 394, 395, 437, 453, 560, 656, 729, 927, 932, 1828, 1848, 1920

751 (AD-A–209696/4/XAB) **Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report.** Hsu, L.; Alavi, B.; Shuh, D.K.; Williams, R.S. California Univ., Los Angeles, CA (USA). 1 Jul 1989. 28p. (TR–17). Available from NTIS, PC A03/MF A01.

Polycrystalline Na-Ga and Ni-In intermetallic compounds of various stoichiometric compositions have been examined by x-ray photoemission spectroscopy. The observed valence-band spectra for all the compounds are very similar to those for elemental Ni; those for Ni_3Ga and NiIn agree rather well with the band-structure calculations of Kubo and others (J.Phys., F17, 397 (1987)) and Collinet and others (Z. Metallkd. 77, 798 (1986)), respectively. Only a partial filling of the empty Ni 3d states occurs on forming compounds with Gallium Indium.

752 (AD-A–209934/9/XAB) **Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989.** Perkins, R.A.; Chiang, K.T.; Meier, G.H.; Miller, R.A. Lockheed Missiles and Space Co., Inc., Palo Alto, CA (USA). Research and Development Div. 23 Jun 1989. 145p. (LMSC-F–352227). Available from NTIS, PC A07/MF A01.

Factors affecting the formation of protective alumina scales on niobium-base alloys by selective oxidation have been investigated. Alumina cannot be formed in air at I atm. on binary Nb-A1 alloys at any N(Al). Theoretical knowledge of selective oxidation was applied to Nb-A1 alloys to alter behavior. The effects of Al content, temperature, atmosphere, third element additions, and microstructure on the transition from internal to external oxidation of aluminum was evaluated, and conditions under which protective alumina scales can form on Nb-A1 alloys were defined. Third element additions are required to form protective alumina. The most effective additions are those that can reduce the solubility and diffusivity of oxygen, enhance diffusion of A1, and limit transient oxidation. Additions of Ti, Cr, V and Si were identified as most promising for providing oxidation resistance in Nb-A1 alloys. The feasibility of forming compact, adherent alumina scales on Nb alloys at a minimum N(A1)=0.32 in air at 1100-1600 C was demonstrated. Alumina scale could not be formed below 1100 C. Preoxidation above 1100 C can be used to preform alumina scales that wil protect at lower temperatures, but is effective only if the alloy is not cooled to room temperature prior to exposure at lower temperatures. Rapid-solidification processing does not appear to offer any significant benefit.

753 (AD-A–209948/9/XAB) **Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989.** Sharpe, W.N.; Douglas, A.S. Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Mechanical Engineering. 15 May 1989. 6p. Available from NTIS, PC A02/MF A01.

An optical technique for measuring the crack-tip opening displacement of pre-cracked three-point-bend specimens subjected to impact loading was developed. Procedures for computing a dynamic Load-CTOD plot were also developed; this enables one to determine the dynamic fracture toughness. Finite-element analyses were used to verify and extend the procedures.

754 (AD-A–210134/3/XAB) **Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988.** Mazumder, J.; Sircar, S.; Kar, A.; Ribaudo, C.; Lober, R. Illinois Univ., Urbana, IL (USA). Laser Aided Materials Processing Lab. Jan 1989. 64p. Available from NTIS, PC A04/MF A01.

This report summarizes experimental and theoretical studies carried out during the period of November 1985 to October 1988 on laser surface modification of nickel, niobium, and magnesium alloys for improved environmental resistance at high temperature. Major emphasis has been on Ni-Cr-Al-Hf system. Microstructural evolution and oxidation properties of Ni and Nb alloys were examined. For Mg alloys microstructural characterization and potentiodynamic corrosion testing were carried out. A one-dimensional diffusion model for finite domain to examine the extended solid solubility in laser cladding was also developed.

755 (AGARD-CP–437-VOL-1, pp. 13) **Arcjet validation of surface catalycity using a viscous shock-layer approach.** Zwan, A.D.; Crooks, R.S.; Whatley, W.J. Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). Dec 1988. (CONF-880532–: American Nuclear Society topical meeting, Seattle, WA (USA), 1-5 May 1988). In *Validation of Computational Fluid Dynamics. Volume 1: Symposium papers and round table discussion.* Available from NTIS, PC A25/MF A01.

A 2-D planar, viscous shock layer code was developed to analyze surface catalytic effects on small, leading edge test specimens in an arcjet environment. An arcjet test was performed to generate validation data for the newly developed code. The test program consisted of testing leading edge test specimens with radii of 0.10, 0.25 and 0.35 inches. Test specimens of each radius were coated with silicon

carbide, silicon monoxide, or nickel. The code predicted the surface recombination rates for silicon carbide and nickel coatings. These rates agree with other values found in similar literature.

756 (AGARD-CP–449) **Application of Advanced Material for Turbomachinery and Rocket Propulsion.** Moore, J.B. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. vp. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). Available from NTIS, PC A13/MF A01.

Gas turbine engines of the 1980's and 1990's will require improved nickel and titanium alloys as well as certain intermetallic compounds and low temperature composites. Engines of the 2000's with significantly higher thrust to weight ratios will require lighter weight, higher temperature non-conventional materials including aluminum alloys, titanium metal matrix composites, intermetallic compounds, and ceramic matrix composites. Major concerns once these materials are developed will be the design, manufacture, inspection, and repair of required components at affordable cost. Current or near-term liquid rocket engines having technology levels equivalent to those being studied for the space transportation and advanced launch systems can benefit from improved materials for turbomachinery, high heat flux throat regions of the thrust chamber, high strength, hydrogen resistant materials for cases and ducts, and refractory materials for uncooled or partially cooled nozzle extensions. To meet the far term goals for advanced rocket engines required for single-stage-to-orbit (SSTO) vehicles materials requirements are not unlike those described above for 21st century gas turbine engines.

757 (AGARD-CP–449, pp. 5) **Vacuum plasma spray coating.** Holmes, R.R. (Rockwell International Corp., Huntsville, AL (USA)); Mckechnie, T.N. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

Currently, protective plasma spray coatings are applied to space shuttle main engine turbine blades of high-performance nickel alloys by an air plasma spray process. Originally, a ceramic coating of yttria-stabilized zirconia ($ZrO_2.12Y_2O_3$) was applied for thermal protection, but was removed because of severe spalling. In vacuum plasma spray coating, plasma coatings of nickel-chromium-aluminum-yttrium (NiCrAlY) are applied in a reduced atmosphere of argon/helium. These enhanced coatings showed no spalling after 40 MSFC burner rig thermal shock cycles between 927 C (1700 F) and -253 C (-423 F), while current coatings spalled during 5 to 25 test cycles. Subsequently, a process was developed for applying a durable thermal barrier coating of $ZrO_2.8Y_2O_3$ to the turbine blades of first-stage high-pressure fuel turbopumps utilizing the enhanced NiCrAlY bond-coating process. NiCrAlY bond coating is applied first, with $ZrO_2.8Y_2O_3$ added sequentially in increasing amounts until a thermal barrier coating is obtained. The enchanced thermal barrier coating has successfully passed 40 burner rig thermal shock cycles.

758 (AGARD-CP–449, pp. 10) **Thrust chamber thermal barrier coating techniques.** Quentmeyer, R.J. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

Methods for applying thermal barrier coatings to the hot-gas side wall of rocket thrust chambers in order to significantly reduce the heat transfer in high heat flux regions has been the focus of technology efforts for many years. A successful technique developed by NASA-Lewis that starts with the coating on a mandrel and then builds the thrust chamber around it by electroforming appropriate materials is described. This results in a smooth coating with exceptional adherence, as was demonstrated in hot fire rig tests. The low cycle fatigue life of chambers with coatings applied in this manner was increased dramatically compared to uncoated chambers.

759 (AGARD-CP–449, pp. 13) **Fiber reinforced superalloys for rocket engines.** Petrasek, D.W.; Stephens, J.R. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

High pressure turbopumps for advanced reusable liquid propellant rocket engines such as that for the Space Shuttle Main Engine (SSME) require turbine blade materials that operate under extreme conditions of temperature, hydrogen environment, high-cycle fatigue loading, thermal fatigue and thermal shock. Such requirements tax the capabilities of current blade materials. Based on projections of properties for tungsten fiber reinforced superalloy (FRS) composites, it was concluded that FRS turbine blades offer the potential of a several fold increase in life and over a 200 C increase in temperature capability over the current SSME blade material. FRS composites were evaluated with respect to mechanical property requirements for SSME blade applications. Compared to the current blade material, the thermal shock resistance of FRS materials is excellent, two to nine times better, and their thermal fatigue resistance is equal to or higher than the current blade material. FRS materials had excellent low and high-cycle fatigue strengths, and thermal shock-induced surface microcracks had no influence on their fatigue strength. The material also exhibited negligible embrittlement when exposed to a hydrogen environment.

760 (BNL–43296) **Exchange coupling in metals as understood then and now.** Watson, R.E. Brookhaven National Lab., Upton, NY (USA). 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891117–3: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90001271. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The first US magnetism conference occurred in 1952 and featured an invited session on exchange coupling in metals with Zener, Slater, Wohlfarth and Van Vleck speaking. All were concerned with intra- and interatomic exchange with Zener discussing coupling via conduction electron polarization while Wohlfarth and Slater were preoccupied with itinerant ferromagnetism. Van Vleck verbalized the Hubbard Hamiltonian (prior to its derivation). That meeting may be viewed as the ultimate discussion of magnetism prior to modern day computation and many of the ideas expressed there underlie our computational activities today. Solutions of the Hubbard Hamiltonian and electronic structure calculations, as applied to magnetism, come to mind. We will concentrate on the latter here, since solving the Hubbard Hamiltonian will be of great concern elsewhere in this meeting, and we will attempt to juxtapose current findings with some of the thoughts of that pioneering meeting. 30 refs., 5 figs.

761 (CEGB-TPRD/L–3261/R88) **Estimating the remanent life of boiler pressure parts: Pt. 3. A metallographic technique for life assessment of parent 1Cr1/2Mo steel.** Askins, M.C. Central Electricity Research Labs., Leatherhead (UK). Apr 1988. 136p. Order Number DE90606331. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

A cast of 1Cr1/2Mo steel has been creep tested in argon at stresses in the range 34-80 MPa and temperatures between 590-630^{0}C in various heat treatment states, including normalized and tempered, and overaged. To assess their use in remanent life evaluations, various techniques have been used including hardness, bulk extraction of carbides and X-ray examination of the phases present, determination of matrix solute content, X-ray determination of the matrix lattice parameter and carbide extraction replication of the structure and measurement of various interparticle spacing parameters. The dependence of the spacing on time and temperature has been established and used to calibrate a model of tertiary creep for the material, based on the coarsening of the interparticle separation. The model is shown to match and predict the material's behaviour well. In application to plant the interparticle spacing can be determined from a small sample removed from the component. The model can be used to give estimates of the time to rupture, or more usefully, estimate the time to any given strain. Of all the techniques used, interparticle spacing determinations give the best estimates of remanent life. (author).

762 (CONF-890771–5) **Magnetic and electrical properties.** Brodsky, M.B.; Mattson, J.E. Argonne National Lab., IL (USA). Aug 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From American Crystallographic Association annual meeting; Seattle, WA (USA); 23-29 Jul 1989. Order Number DE90002183. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of controlled growth of monolayers and thin metallic films has led to a number of studies in which the magnetic and electrical properties are modified by interfaces. The thrust of his paper is to consider cases where the property modifications are caused by structural changes driven by the interfaces. Types of systems to be considered include free surfaces, thin layers, film sandwiches and superlattices. As will be shown, there are often observed property changes where the underlying, structural change is not clearly delineated. The literature is extensive and only a sample may be given here. 16 refs., 14 figs.

763 (CONF-890820–5) **Accelerated aging embrittlement of cast duplex stainless steel: Activation energy for extrapolation.** Chung, H.M.; Chopra, O.K. Argonne National Lab., IL (USA). May 1989. 35p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From 4. international symposium on environmental degradation of materials in nuclear power systems: water reactors; Jekyll Island, GA (USA); 6-10 Aug 1989. Order Number DE90001773. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Cast duplex stainless steels, used extensively in LWR systems for primary pressure boundary components such as primary coolant pipes, valves, and pumps, are susceptible to thermal aging embrittlement at reactor operating or higher temperatures. Since a realistic aging embrittlement for end-of-life or life-extension conditions (i.e., 32–50 yr of aging at 280–320°C) cannot be produced, it is customary to simulate the metallurgical structure by accelerated aging at ~400°C. Over the past several years, extensive data on accelerated aging have been reported from a number of laboratories. The most important information from these studies is the activation energy, namely, the temperature dependence of the aging kinetics between 280 and 400°C, which is used to extrapolate the aging characteristics to reactor operating conditions. The activation energies (in the range of 18–50 kcal/mole) are, in general, sensitive to material grade, chemical composition, and fabrication process, and a few empirical correlations, obtained as a function of bulk chemical composition, have been reported. In this paper, a mechanistic understanding of the activation energy is described on the basis of the results of microstructural characterization of various heats of CF-3, -8, and -8M grades that were used in aging studies at different laboratories. The primary mechanism of aging embrittlement at temperatures between 280 and 400°C is the spinodal decomposition of the ferrite phase, and $M_{23}C_6$ carbide precipitation on the ferrite/austenite boundaries is the secondary mechanism for high-carbon CF-8 grade. 20 refs., 10 figs., 3 tabs.

764 (CONF-891117–5) **Magnetotransport studies of epitaxial Cr thin films.** Mattson, J.; Brumitt, B.; Brodsky, M.B.; Ketterson, J.B. Argonne National Lab., IL (USA). 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989. Order Number DE90001930. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We report the results of transport measurements on epitaxial Cr thin films. The variation of T_N (the Neel transition) with respect to the film thickness is discussed in terms of the stress in the film. In addition, the temperature dependence of the magnetoresistance (MR) and Hall effect for temperatures from 4 K to 150 K are also discussed, with particular attention to the temperature dependence of the non-linear portion of the Hall data. 8 refs., 6 figs.

765 (CONF-891119–1) **Deformation twinning in ordered intermetallic compounds.** Yoo, M.H.; Fu, C.L.; Lee, J.K. Oak Ridge National Lab., TN (USA). 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE89014779. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Mechanistic understanding of deformation twinning in ordered superlattice structures is reviewed, and the inter-relationships between twinning and generalized plastic flow or fracture toughness are discussed. While general discussions refer to all the fcc-based and bcc-based cubic and noncubic ordered intermetallic alloys, specific calculations of the energetic and kinetic aspects of deformation twinning are made for TiAl. The importance of the twin-slip conjugate relationship on high temperature mechanical properties is emphasized. Discussion is given of possible effects of macro- and micro-alloying on twinning propensity. 40 refs., 4 figs., 2 tabs.

766 (CONF-8906112–3) **Approximate methods for dynamic plastic deformation of structures.** Youngdahl, C.K. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. symposium on energy engineering sciences; Argonne, IL (USA); 19-21 Jun 1989. Order Number DE90002214. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To illustrate the development of approximation methods and correlation parameters for dynamic plasticity, the problem of a long tube loaded by a time-dependent region is considered for a rigid, perfectly plastic material. The final plastic deformation is found to depend on an effective applied force, an effective applied moment, an effective length of the loaded region, and the deformation which would be attained if the loading were applied impulsively. A procedure is developed for approximating the results by closed-form solutions for loadings applied to fixed regions. The implications of the solutions with respect to other approximation methods and extension of the method to include strain hardening effects are discussed. 4 refs., 6 figs.

767 (CONF-8907114–3) **Theory of the energetics and nonclassical nucleation for martensitic transformations from partially soft lattice modes.** Chan, S.-K. Argonne National Lab., IL (USA). Jul 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on martensitic phase transformations (ICOMAT-89); Sydney (Australia); 3-7 Jul 1989. Order Number DE90002182. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A nonclassical approach to the energetics and nucleation in martensitic transformations has been developed, based on the concept of partial softening of lattice modes and the use of continuum mechanics. It is shown that from an expansion of the free energy density in powers of symmetry-adapted strains, the nature of the instability and the degree of asymmetry of supercooling and superheating can be explained in terms of the temperature dependence of some elastic constants. It is further shown that by including spatial gradients, the critical radius of nucleation as a function of temperature and of compressive and shear stresses can be obtained. 8 refs., 6 figs.

768 (DOE/ER/13834–8) **Magnetic behavior of curium and americium-curium alloys.** Nave, S.E.; Haire, R.G.; Moore, J.R. Tennessee Univ., Knoxville, TN (USA). Dept. of Physics. Sep 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13834. (CONF-8909225–1: Actinides '89, Tashkent (USSR), 24-29 Sep 1989). Order Number DE89017808. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report briefly looks at the magnetic interactions, electronic properties and structures of the transplutonium metals, curium and americium. 6 refs. (JF)

769 (DOE/FTR–90001293) **[Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989.** Davenport, A.J. Brookhaven National Lab., Upton, NY (USA). 11 Oct 1989. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001293. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The symposium was the 6th in a series at approximately 5 year intervals on the passivation of metals and semiconductors. It was attended by about 200 scientists. The sections of the symposium included methods for characterizing the structure and composition of passive films, passivity of metals, alloys and amorphous alloys, passivity breakdown, kinetics of passivation, electronic and optical properties of passive films and a round table discussion on the

"Present Status and Prospects of Corrosion Science and Engineering." Discussions with a number of scientists involved with corrosion research in different Japanese Laboratories took place. The subjects discussed included new methods for detecting corrosion, fundamental ideas in corrosion research and corrosion of metal contacts in VLSI applications.

770 (ECRC/M–2380) **Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties.** Wilford, C.F.; Clarkson, I. Electricity Council Research Centre, Capenhurst (UK). Jun 1989. 55p. Available from Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

An investigation has been carried out comparing the tensile properties of austempered ductile iron castings produced by the hot knock-out route with those produced by the conventional method of heat treating the casting from cold. Following hot knock-out, the advisability of incorporating a 30 minute hold in the austenite temperature range has been demonstrated. When this is done, the tensile properties are at least as good as those produced conventionally. The hot knock-out approach is shown to offer a saving of some 200kWh per tonne of finished castings. The ability to utilise a smaller salt bath than normally used with the conventional method, when following the hot knock-out approach is also discussed. (author).

771 (EUR–11799) **Constitutive modelling in the range of inelastic deformations.** Bruhns, O.T.; White, P.S.; Chaboche, J.L.; Eikhoff, J.V.D. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 179p. Available from NTIS (US Sales Only), PC A09/MF A01.

The main objective of this report is to describe the state of the art in constitutive modelling in the range of inelastic deformations, with particular consideration of the practical use of these models in the field of fast reactors, rather than to formulate new models. An outline is given of the constitutive equations for high-temperature reactor materials developed at the Oak Ridge National Laboratory. Two forms of equations are considered, a semi-classical treatment in terms of separate plasticity and creep and unified equations in which the classical plasticity does not explicitly occur. The fraction model originally proposed by Besseling is described. The basic concept of this model is that the material is thought to be subdivided into a number of parallel fractions, each with simple conventional properties. The more complicated behaviour of real material is thus approximated by choosing a number of parallel fractions with suitable models and model parameters. Three time-independent formulations of plasticity are considered and compared. Attention is focused on the kinematic hardening in the multi-yield surface theory of Mroz and the non-linear kinematic rule intensively used at Enset and Onera. Some connections are pointed out with the two-surface model of Dafalias and Popov, and the range of applicability of the different models is studied in detail. Finally, the constitutive equations of the Interatom model are presented. They are mainly based on the concept of overstresses, expressing the rate-dependence of the material by the magnitude of these overstresses. This model furthermore comprises a combination of general non-linear isotropic and kinematic hardening, with a smooth transition from isotropic to kinematic hardening as a function of process time.

772 (IABG-TF–1950) **Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress.** Schaefer, R. Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Jan 1986. 49p. (In German). Contract BMFT 01 ZT 051 3. Order Number DE90711185. Available from NTIS (US Sales Only), PC A03/MF A01.

Starting out from the problem of the decrease of the vibration resistance or lifespan as a result of friction stress, a problem which occurs in aircraft engine construction at the connection between rotor disk and blade root, friction/vibration resistance investigations were carried out on the titanium alloy Ti Al6 V4, which is the most frequently used. The aim of the investigations was to determine the influence of essential parameters on the friction vibration resistance and to test possibilities of improving them. Shot blasting is a suitable method for a clear increase of the friction vibration resistance at room temperature as well as at 350^{0}C. In comparison to untreated samples, the fatigue strength was increased by about 150% at room temperature and by 120% at 350^{0}C, thus attaining about 70% or 65% respectively of the fatigue strength without friction stress. Attempts to increase the friction vibration stress also by coating with a cobalt chromium oxide dispersion layer and with PVD titanium nitride layers were, however, less successful. At room temperature the fatigue friction strength could be increased at best by 40%, at 350^{0}C by 70%, thus attaining about 40% or 50% respectively of the fatigue strength without friction stress. (orig./MM).

773 (INIS-mf–12010) **Pulsed TIG welding of pipes. Final report.** Killing, U. Dortmund Univ. (Germany, F.R.). Lehrstuhl fuer Werkstofftechnologie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). [1989]. 86p. (In German). Order Number DE90717901. Available from NTIS (US Sales Only), PC A05/MF A01.

The present study investigates into the effects of impulse welding parameters on weld geometry in the joint welding of thin-walled sheets and pipes (d=2.5 mm), and it uses random samples of thick-walled sheets and pipes (d=10 mm), in fixed positions. (orig./MM).

774 (INIS-mf–12014) **Quantitative analysis of the precipitation conditions in fine grained structural steel for materials characterization.** Technisch-wissenschaftliche Berichte der Staatlichen Materialpruefungsanstalt, Universitaet Stuttgart. Schroeder-Obst, D. Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt. 1988. 285p. (In German). Order Number DE90717898. Available from NTIS (US Sales Only), PC A13/MF A01.

In the framework of the preparation of the atlas of structures of structural materials, mechanical-technological, metallographic, phase-analytical and electron microscopic investigations were carried out on 17 melts (11 production and 6 test melts with graduated Al and N contents) of the material 15 NiCuMoNb 5 for the characterization of the welding properties. The investigations were focussed on the quantification of the microstructure parameters. The reason for the investigations was the occurrence of uncertainties concerning relaxation-induced cracking in welding. The results confirm the possibility of a decrease of the relaxation capacity by precipitation processes, which are favoured by coarse grain formation or expansion, as well as by grain boundary embrittlement. Which mechanism, however, takes effect depends essentially on the chemical composition of the melt. (orig./MM).

775 (KFA-IRW-TN–69/84) **Application of the d.c. potential method for continuous crack length measurement in CT samples of Incoloy 800 H at temperatures above 800^{0}C.** Kwasny, R.J.; Roedig, M. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe. 17 Jul 1984. 21p. (In German). Available from Copy held by UB/TIB Hannover.

rhe direct-current potential method for continuous crack length measurements, which is designed to be applied at temperatures above 800^{0}C, is introduced. This method is optimized with respect to the positions of initial current and potential tapping points, with the aim of obtaining an optimal synthesis of reproducibility, sensitivity and signal-to-noise ratio. Calibration curves were determined experimentally by simulating the crack with saw cuts. These were compared with finite-element calculations from relevant literature, and tested in an experiment on the growth of fatigue cracks. A first attempt made in an experiment on the growth of fatigue cracks in Incoloy 800 H at 850^{0}C is presented. (orig.).

776 (LAPP-EXP–88-09) **Irradiation of superheated superconducting tin granules with low energy photons, at temperatures below 1 k.** Boniface, J.; Ditta, J.; Gonzalez-Mestres, L.; Massonnet, L.; Meylan, D.; Perret-Gallix, D. Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules. 1988. 4p. (CONF-8805212–:). Order Number DE90713780. Available from NTIS (US Sales Only), PC A02/MF A01.

We briefly present recent results on irradiation of 10 μm < PHI (diameter) < 25μm tin granules at ^{3}He temperatures (T $\simeq$ 400 mK). The sources used were: ^{57}Co (E_γ < 136 keV) and ^{55}Fe ($E_\gamma \simeq$6 keV). A clear increase in sensitivity, with respect to previous tests using similar samples at T $\simeq$ 1.5 K, is reported.

777 (LA-UR-89-3135) **Multiple martensitic transformations, incommensurate/commensurate phases and charge-density-wave states in plutonium metal: Their consequences.** Sandenaw, T.A.; Andrew, J.F. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8909225–2: Actinides '89, Tashkent (USSR), 24-29 Sep 1989). Order Number DE90001235. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Simultaneous measurements of electrical resistivity, elongation and temperature have been made on a Pu metal specimen between ~80K and 733K. This temperature range covers part of the α-phase range and up through a major portion of the δ-phase range. Results are discussed. 7 refs., 3 figs.

778 (LBL–27249) **The science of thermomechanical processing.** Morris, J.W. Jr. Lawrence Berkeley Lab., CA (USA). Jun 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891194–1: First international SAMPE symposium and exhibition, Tokyo (Japan), 28 Nov - 1 dec 1989). Order Number DE90000167. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper provides a brief overview of thermomechanical processing: treatments that combine heat and mechanical work to achieve microstructures that impart useful engineering properties. Thermomechanical processes can be categorized on the basis of the primary microstructural element they affect, as is done below. 6 refs.

779 (LBL–27377) **The metallurgical determinants of toughness as cryogenic temperature.** Morris, J.W. Jr.; Glazer, J.; Chan, J.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890701–15: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90002331. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cryogenic structural materials can be roughly divided into three classes on the basis of the behavior that determines the strength-toughness characteristic at low temperature. The first class includes materials that undergo a ductile-brittle transition that dominates low-temperature behavior. The second includes materials that remain ductile at all temperatures, whose low-temperature toughness is governed by the interplay of strength and ductility. The third class includes metastable alloys whose ductility and toughness are largely determined by a low-temperature phase transformation. Current models of fracture give some mechanistic insight into the behavior of each class. 17 refs., 5 figs.

780 (LBL–27378) **4.2 K fracture toughness of 304 stainless steel in a magnetic field.** Chan, J.W.; Glazer, J.; Mei, Z.; Morris, J.W. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890701–14: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90002083. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Metastable austenitic steels are used in the structure of high field of superconducting magnets. In this application the alloys sustain high stresses in high magnetic fields at 4.2 K. Safe and effective design demands complete characterization of tensile, fatigue, and fracture toughness behavior of these alloys under the anticipated operating conditions. The characterization problem is complex because these metastable austenitic steels can undergo strain-induced martensitic transformation at cryogenic temperatures. The available data on the behavior of metastable austenitic steels in magnetic fields at 4.2 K is somewhat confusing. It is known that the presence of a high magnetic field during deformation can enhance martensitic transformation in Ni, Ni-Cr, and Mn steels. The tensile behavior and the fatigue behavior of 304L and 304LN, which are, respectively, less stable and more stable than 304, have also been investigated in some detail in higher strength fields. Yield strength and fatigue property changes between tests performed in a magnetic field and without a magnetic field were not significant while the ultimate strength increased only slightly. The present work was undertaken to determine the extent and nature of the fracture toughness change of 304 stainless steel at 4.2 K in an 8 T magnetic field.

781 (LBL–27563) **STM study of the structure of sulfur ($2\sqrt{3} \times 2\sqrt{3}$)R30° overlayer on rhenium (0001).** Ogletree, D.F.; Ocal, C.; Marchon, B.; Somorjai, G.A.; Salmeron, M.; Beebe, T.; Siekhaus, W. Lawrence Berkeley Lab., CA (USA). Jul 1988. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8907157–1: 4. international conference on STM, Oarai (Japan), 10-14 Jul 1989). Order Number DE90001568. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The structure of the sulfur overlayer chemisorbed on rhenium(0001) has been studied with scanning tunneling microscopy. The ordered sulfur overlayer was prepared in UHV and then transferred through air to an STM operating at a vacuum of 10^{-7} Torr. The sulfur overlayer passivates the rhenium substrate in air. STM images show the atomic structure of the overlayer unit cell to be a hexagonal ring of six sulfur atoms. Defect structures in the two dimensional lattice of sulfur hexagons, overlayer domain boundaries and substrate dislocations were also observed. 17 refs., 8 figs.

782 (N–89-18528) **Materials Division research and technology accomplishments for FY 87 and plans for FY 88.** Brinkley, K.L. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Dec 1988. 134p. (NASA-TM–101506;NAS–1.15:101506). Available from NTIS, PC A07/MF A01.

The research program of the Materials Division is presented as FY 87 accomplishments and FY 88 plans. The accomplishments for each Branch are highlighted and plans are outlined. Publications of the Division are included by Branch. This material will be useful in program coordination with other government organizations, universities, and industries in areas of mutual interest.

783 (N–89-19371) **Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009.** Hebsur, M.G.; Titran, R.H. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Sep 1988. 12p. (NASA-TM–101954;E–4311;NAS–1.15:101954;CONF-8809322–: TMS fall meeting, Chicago, IL (USA), 25-30 Sep 1988). Available from NTIS, PC A03/MF A01.

Due to its high strength at temperatures up to 1600 K, fabrication of niobium base alloy WC-3009 (Nb30Hf9W) by traditional methods is difficult. Powder metallurgy (P/M) processing offers an attractive fabrication alternative for this high strength alloy. Spherical powders of WC-3009 produced by electron beam atomizing (EBA) process were successfully consolidated into a one inch diameter rod by vacuum hot pressing and swaging techniques. Tensile strength of the fully dense P/M material at 300-1590 K were similar to the arc-melted material. Creep rupture tests in vacuum indicated that WC-3009 exhibits a class 1 solid solution (glide controlled) creep behavior in the 1480 to 1590 K temperature range and stress range of 14 to 70 MPa. The creep behavior was correlated with temperature and stress using a power law relationship. The calculated stress exponent n, was about 3.2 and the apparent activation energy, Q, was about 270 kJ/mol. The large creep ductility exhibited by WC-3009 was attributed to its high strain rate sensitivity.

784 (N–89-23528, pp. 133-159) **Returned Solar Max hardware degradation study results.** Triolo, J.J.; Ousley, G.W. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. May 1989. (NASA-CP–3035-PT-1;L–16575-PT-1;NAS–1.55:3035-PT-1;CONF-8806434–: NASA/SDIO space environmental effects on materials workshop, Hampton, VA (USA), 28 Jun - 1 jul 1988). In *NASA/SDIO Space Environmental Effects on Materials Workshop, part 1.* Available from NTIS, PC A16/MF A01.

The Solar Maximum Repair Mission returned with the replaced hardware that had been in low Earth orbit for over four years. The materials of this returned hardware gave the aerospace community an opportunity to study the realtime effects of atomic oxygen, solar radiation, impact particles, charged particle radiation, and molecular contamination. The results of these studies are summarized.

785 (N–89-25285) **Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis.** Hurst, J.B. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. May 1989.

21p. (NASA-TM–102004;E–4710;NAS–1.15:102004). Available from NTIS, PC A03/MF A01.

Three efforts aimed at investigating the process of self-propagating high temperature synthesis (SHS) for the fabrication of structural ceramics and intermetallics are summarized. Of special interest was the influence of processing variables such as exothermic dopants, gravity, and green state morphology in materials produced by SHS. In the first effort directed toward the fabrication of SiC, exothermic dopants of yttrium and zirconium were added to SiO2 or SiO2 + NiO plus carbon powder mix and processed by SHS. This approach was unsuccessful since it did not produce the desired product of crystalline SiC. In the second effort, the influence of gravity was investigated by examining Ni-Al microstructures which were produced by SHS combustion waves traveling with and opposite the gravity direction. Although final composition and total porosities of the combusted Ni-Al compounds were found to be gravity independent, larger pores were created in those specimens which were combusted opposite to the gravity force direction. Finally, it was found that green microstructure has a significant effect on the appearance of the combusted piece. Severe pressing laminations were observed to arrest the combustion front for TiC samples.

786 (N–89-26049) **High temperature Be panel development.** Hardesty, R.; Jensen, M.; Grant, L. Electrofusion Corp., Fremont, CA (USA). May 1989. 22p. (NASA-CR–181777;L–11737;NAS–1.26:181777). Available from NTIS, PC A03/MF A01.

Beryllium materials have been used for many aerospace applications over the years. Most of these applications have been fairly ambient environments. The possibility of fabricating beryllium panels for high temperature applications up to 1200 F is investigated. Joining alloys were reviewed, tested and evaluated for high temperature applications.

787 (ORNL/FTR–2972) **[Modeling and experimental efforts on ordered intermetallic alloys]: Foreign trip report, May 21–June 5, 1988.** Pettifor, D.G.; Willis, A.J. Oak Ridge National Lab., TN (USA). 29 Jul 1988. 10p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90001748. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The travelers spent one week each at ORNL and LANL visiting the groups which are currently involved in the Materials by Design directive of the ECUT Materials Program. The progress made and problems encountered in using the senior traveler's phenomenological structure maps in the search for new cubic, ductile, ordered intermetallics were reviewed. The problems of limited solid solubility and brittleness of certain cubic alloys were noted and a specific trialuminide system identified for future collaborative experimental and theoretical investigation.

788 (ORNL/FTR–3068) **[Welding and melting by electron and laser beams]: Foreign trip report, September 11–October 2, 1988.** Vitek, J.M. Oak Ridge National Lab., TN (USA). 12 Oct 1988. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001302. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The 4th International Colloquium on Welding and Melting by Electron and Laser beams provided an opportunity to survey current research of workers in several foreign countries. The conference also allowed for the presentation of our results on rapidly cooled stainless steels to a community that was basically unfamiliar with our work. The visits to the other laboratories provided the traveler the opportunity to learn of current activities at these research centers in the areas of solidification theory, transformation behavior, analytical electron microscopy, and other topics. Plans for future collaborative work between Oak Ridge National Laboratory (ORNL) and Cambridge University and EPFL were also discussed. In particular, collaborative work on phase transformation in welds and heat-affected zones in steels was discussed at Cambridge University. A continuation of ongoing work on welding of single crystals was discussed at EPFL.

789 (ORNL/FTR–3180) **[Physical metallurgy and mechanical behavior of ordered intermetallics]: Foreign trip report, January 19, 1989–February 3, 1989.** Liu, C.T. Oak Ridge National Lab., TN (USA). 17 Feb 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002141. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During my vacation in Taiwan, ROC, I attended the seminar on intermetallic compounds, sponsored by National Taiwan University on January 23–27, 1989. I gave invited lectures on ordered intermetallic alloys – physical metallurgy and mechanical behavior. At the seminar, I learned about recent research and development of ordered intermetallics conducted in Taiwan, ROC.

790 (ORNL/FTR–3245) **[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989.** Haire, R.G. Oak Ridge National Lab., TN (USA). 20 Oct 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002145. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of the foreign travel was to attend the International Conference "Actinides-89," and present an invited plenary lecture. This International Conference, held every four years, is dedicated to recent research and technology with the actinides. In addition to the scientific presentations, the traveler also benefited from frequent technical discussions with a number of the conference attendees. The traveler received several technical preprints not included in the Conference's written program. These dealt with phase diagrams of plutonium-americium and plutonium-curium, and with high-temperature studies of curium metal. These topics are very pertinent to the traveler's research interests and areas of work. Another important benefit of the travel was learning in other laboratories. The traveler also visited an isotope production reactor at the Institute of Nuclear Physics, Academy of Sciences of UzbekSSR.

791 (ORNL/FTR–3379) **[Welding under extreme conditions]: Foreign trip report, August 29, 1989–September 14, 1989.** Davis, S.A. Oak Ridge National Lab., TN (USA). 29 Sep 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001497. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler was an invited member of the Unites States delegation and representative of the Basic Energy Science Welding Science program at the 42nd Annual International Institute of Welding (IIW) Assembly and Conference held in Helsinki, Finland. The conference and the assembly was attended by about 600 delegates representing 40 countries. The theme of the conference was welding under extreme conditions. The conference program contained several topics related to welding in nuclear, arctic petrochemical, underwater, hyperbaric and space environments. At the annual assembly the traveler was a delegate (US) to two working groups of the IIW, namely Commission IX and welding research study group 212. Following the conference the traveler visited the Danish Welding Institute in Copenhagen and the Risoe National Laboratory in Roskilde. Prior to the conference the traveler visited Lappeenranta University of Technology and presented an invited seminar entitled "Recent Advances in Welding Science and Technology."

792 (ORNL/FTR–3397) **[Future of electron microscopy]: Foreign trip report, September 11–30, 1989.** Bentley, J. Oak Ridge National Lab., TN (USA). 16 Oct 1989. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001496. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The stimulating, informed, and creative discussions of the collection of European and North American experts at the Giens workshop provided very thorough and useful assessments of the future of electron microscopy. They will help guide decisions on the development of electron microscopy facilities at ORNL for materials science applications. The scope of British (and some European) electron microscopy research, much of it never presented in the USA, was well covered at the EMAG MICO '89 conference. Valuable information on electron microscopy techniques, phase transformations of ordered and intermetallic alloys, dislocation core structures, and deformation mechanisms was obtained from the meetings and laboratory visits, as were many practical tips on instrumentation, analysis methods, and specimen preparation. Problems with 400 kV stability on JEM 4000 instruments seem universal.

793 (ORNL/FTR–3400) **[Lithium and lead-lithium corrosion and chemistry]: Foreign trip report, September 18–26, 1989.** Tortorelli, P.F. Oak Ridge National Lab., TN (USA). 9 Oct 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001245. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Presentations on "Mass Transport Processes in Li/Fe-12Cr-1MoVW Steel," "A Lower Temperature Lithium Purification Process Incorporating 'Warm Trapping'," and "Kinetic Analysis of Corrosion in Pb-17 at. % Li and Comparison to Pure Lithium" were given by the traveler at the 1989 European Workshop on Lithium and Lead-Lithium Corrosion and Chemistry in Vienna, Austria. The European effort in lead-lithium appeared to be continuing unabated with a future focus on deposition and surface products reactions that can lead to corrosion control. The temperature gain realized from the use of ferritic/martensitic steels instead of austenitic steels in Pb-17 at. % Li appears to be 25–50°C. The traveler also visited the European Community's Joint Research Centre at Ispra to discuss Fe-Mn-Cr steels. He presented a seminar on "Recent ORNL Results on the Development of Fe-Mn-Cr Steels," and toured the liquid metal laboratories. Our developmental Fe-Mn-Cr steels, which are compositionally tailored for shallow land burial, would not qualify as "low activation" materials per European standards. Because of both this and the poor sensitization resistance of these steels, our alloy development strategy for reduced activation materials should be critically reviewed.

794 (ORNL/FTR–3418) **[Geometrical structural properties in the selvedge region of surfaces of random alloys]: Foreign trip report, July 21–September 30, 1989.** Zehner, D.M. Oak Ridge National Lab., TN (USA). 16 Oct 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001494. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler was on foreign research assignment at the Universitaet Erlangen-Nuemberg from July 24 to September 28, 1989. He participated in a collaborative research effort concerned with determining the surface properties of random alloys. The traveler visited four laboratories while in FRG and attended the 11th International Vacuum Congress and 7th International Conference on Solid Surfaces, where an invited paper was presented. Comments and observations related to interactions during the visit are given, and examples of benefits provided to ongoing surface science research programs at ORNL are presented.

795 (PB–89-869127/XAB) **Electroplating of copper. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 126p. Available from NTISPC N01/MF N01.

Supersedes PB–87-869012.

This bibliography contains citations concerning the electroplating of copper. The use of plated copper in solar cells and associated heat exchangers is emphasized. The mechanical properties of thin copper films are discussed in terms of deposit stress and adherence. The electrodeposition of copper on non-metallic surfaces is also presented. Problems associated with corrosive plating-bath electrolytes and the disposal of plating waste are also included. (This updated bibliography contains 242 citations, 104 of which are new entries to the previous edition.)

796 (PB–89-869317/XAB) **Water-based anticorrosion coatings. January 1980-January 1988 (Citations from World Surface Coatings Abstracts). Report for January 1980-January 1988.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 151p. Available from NTISPC N01/MF N01.

See also PB–89-869325.

This bibliography contains citations concerning the composition and preparation of water-based paints and coatings that have good anticorrosion and weather-resistant qualities. Included are citations on the preparation of surfaces to be coated, application by electrocoating, and on properties, such as adhesion, durability, and air-drying capabilities. (This updated bibliography contains 400 citations, none of which are new entries to the previous edition.)

797 (PB–89-869325/XAB) **Water-based anticorrosion coatings. February 1988-July 1989 (Citations from World Surface Coatings Abstracts). Report for February 1988-July 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 55p. Available from NTISPC N01/MF N01.

Supersedes PB–88-856356. See also PB–89-869317.

This bibliography contains citations concerning the composition and preparation of water-based paints and coatings that have good anticorrosion and weather-resistant qualities. Included are citations on the preparation of surfaces to be coated, application by electrocoating, and on properties, such as adhesion, durability, and air drying capabilities. (This updated bibliography contains 91 citations, all of which are new entries to the previous edition.)

798 (PNL-SA–16212) **Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation.** Garner, F.A.; McCarthy, J.M. Pacific Northwest Lab., Richland, WA (USA). Feb 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8902117–3: Symposium on physical metallurgy of controlled expansion invar-type alloys, Las Vegas, NV (USA), 28 Feb 1989). Order Number DE90002667. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Studies conducted in fast reactors at 420–600°C show that simple Fe-Ni and Fe-Ni-Cr alloys in the Invar compositional range decompose in a spinodal-like manner. Irradiations with 5 MeV Ni^+ ions at much higher displacement rates indicate that separation occurs at least as high as 725°C. The decomposition is characterized by compositional micro-oscillations between ~25 and ~50% Ni with temperature-dependent wavelengths on the order of hundreds of nanometers to microns with a crystalline regularity consistent with that produced by spinodal decomposition. Chromium appears to play no role other than as a substitute for iron. Depending on the alloy composition and irradiation conditions there are a variety of consequences associated with the decomposition, including lattice parameter changes, cellular martensite formation, spinodal-like hardening and highly selective electropolishing behavior. 20 refs., 18 figs.

799 (SAND–89-2413C) **Hydrogen assisted cracking of palladium modified PH 13-8 Mo stainless steel.** Scully, J.R.; Van Den Avyle, J.A.; Cieslak, M.J.; Hills, C.R. Sandia National Labs., Albuquerque, NM (USA). [1989]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909204–3: Conference on hydrogen effects on material behavior, Jackson Hole, WY (USA), 12-16 Sep 1989). Order Number DE90001501. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We compare the hydrogen assisted cracking resistance of wrought PH 13-8 Mo stainless steel alloyed with 0.4 to 1.0 wt.% palladium to the conventional alloy when aged to yield strengths of 1170–1250 MPa. Pd is found both in solid solution in the martensitic phase and also in the form of randomly distributed, incoherent PdAl precipitates in the modified alloy. Interfacial segregation of Pd to grain boundaries and lath boundaries is not observed. Intergranular hydrogen cracking is suppressed with Pd in slow strain rate tests conducted during electrochemical hydrogen charging of precharged samples. Hydrogen permeation analyses indicate that hydrogen ingress is not inhibited by Pd but that bulk diffusion rates are lowered relative to the conventional alloy. These results are consistent with the creation of a strong hydrogen trap, most likely the uniformly distributed PdAl phase, which lowers the levels of interfacially segregated hydrogen. 15 refs.

800 (UCRL–100833) **Micron-thin Nb films recovered from Mbar shock pressures.** Nellis, W.J.; Koch, R.; Davidson, H.; Hunter, J.W.; Brocius, W.F.; Marshall, A.; Geballe, T.H. Lawrence Livermore National Lab., CA (USA). Sep 1989. 4p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-890812–59: American Physical Society topical conference on shock compression of condensed matter, Albuquerque, NM (USA), 14-17 Aug 1989). Order Number DE90001509. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Niobium films of thickness 1, 2.5, 5, and 10 μm were subjected to shock pressures of 0.72 and 0.97 Mbar. The recovery technique and the results of microstructural investigations of the recovered films are described. 2 refs., 1 fig.

801 Electrodeposition of cadmium from aqueous fluoborate electrolytes. Varma, R.; Shimotake, H.; Hoeller, T.L.; Agarwala, V. 10p. National Assoc. of Corrosion Engineers, Houston, TX (1988). (CONF-880314--: Corrosion '88: National Association of Corrosion Engineers meeting, St. Louis, MO (USA), 21-25 Mar 1988).

Technical Paper 88388.

A new method of electroplating cadmium on high-strength steel from aqueous fluoborate electrolytes has been developed at Argonne National Laboratory. The cadmium coatings are fine grained, coherent, and strongly adherent to the substrate. With this method, a high-rate electrodeposition is achieved in an electrolyte flow cell using an optimized pulse-nucleation step followed by deposit growth under a DC or pulsed current. This method result in minimal hydrogen codeposition during plating, which can lead to steel embrittlement.

802 Nonlinear fracture mechanics. Volume 2. Elastic-plastic fracture. ASTM Special Technical Publication, No. 995. Landes, J.D.; Saxena, A.; Merkle, J.G. 639p. American Society for Testing and Materials, Philadelphia, PA (US) (1989).

Papers are presented on such topics as the experimental and numerical validation of a ductile fracture local criterion based on cavity growth simulation, plasticity near a blunt flaw under remote tension, the evaluation of steel toughness using various elastic-plastic fracture toughness parameters, and fracture mechanics tests on welded joints. Consideration is also given to a methodology for ductile fracture analysis based on damage mechanics, the prediction of critical crack size in plastically strained welded panels, and a combined statistical and constraint model for the ductile-brittle transition region.

803 The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr. Hou, P.Y. (Univ. of California, Berkeley (USA)); Stringer, J. *Oxidation of Metals (USA)*, 29(1-2): 45-73 (Feb 1988). DOE Contract AC03-76SF00098.

Specimens of Co-25 wt.% Cr, Co-25 wt.% Cr-1 wt.%Y, and yttrium-implanted Co-25 wt.% Cr alloy were oxidized at 100°C in 1 atm O_2. The implantation dosage ranged between 10^{16} to 10^{18} ions/cm^2. The unimplanted binary alloy oxidized to a duplex Co-rich scale, but the Y-containing ternary alloy formed a continuous Cr_2O_3 layer. When the implantation dosages were lower than a nominal 10^{18} ions/cm^2, the alloy failed to develop a similar continuous Cr_2O_3 layer as that observed with the Y-containing alloy. A temporarily stable external Cr_2O_3 scale was formed on the most heavily implanted specimen (1×10^{18} Y$^+$/cm^2). This Cr_2O_3 scale consisted of very fine-grained oxide, which is permeable to the outward transport of Cr and Co. Internal oxidation pretreatment of the ion-implanted specimens converting the Y metal to its oxide prior to the oxidation experiment, can enhance the development of an external Cr_2O_3 scale, but this scale is also unstable. Results suggest that the selective oxidation of chromium in an ordinarily non-Cr_2O_3-forming alloy can be due to the reactive element oxides acting as preferential nucleation sites on the alloy surfaces, but the subsequent growth of these scales may require a continuous supply of reactive elements in the alloy.

804 On the atomic structure of the Nb/Al_2O_3 interface and the growth of Al_2O_3 particles. Kuwabara, M. (Department of Physics, Arizona State University, Tempe, Arizona 85287-1504 (US)); Spence, J.C.H.; Ruhle, M. *Journal of Materials Research (USA)*, 4(4): 972-977 (Jul 1989).

The growth mechanism for small precipitates of Al_2O_3 formed by internal oxidation in the Nb–Al_2O_3 interface is studied in detail. The observations show that the Nb(001)/Al_2O_3 (00.1) interface is almost atomically flat and that there are no interface compounds. We suggest that the final layer on the Al_2O_3 side of this interface consists of oxygen atoms. The effects of image forces on misfit dislocations are found to result in a standoff distance between dislocation cores and the interface, in good agreement with the recent theory. The implications of this for the strength of metal-ceramic bonding are discussed.

805 Reactions at the interface between multi-component glasses and metallic lithium films. Zavadil, K.R. (Department of Chemistry, The University of Arizona, Tucson, Arizona 85721 (US)); Armstrong, N.R.; Peden, C.H.F. *Journal of Materials Research (USA)*, 4(4): 978-989 (Jul 1989). DOE Contract AC04-76DP00789.

The reactions of vacuum deposited thin films of lithium with various complex glassed have been explored using x-ray photoelectron spectroscopy (XPS). In contrast to lithium reactions with simple glasses such as silica or boron oxides, the reactions are predominantly those of the network modifiers such as sodium, potassium, and magnesium. XPS and x-ray induced Auger lineshapes indicate the migration of the network modifier to the near surface region followed by its reduction. In the case of magnesium, there is evidence for stable alloy formation with unreacted lithium following these migration and reduction steps.

806 The equation of state of platinum to 660 GPa (6.6 Mbar). Holmes, N.C. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Moriarty, J.A.; Gathers, G.R.; Nellis, W.J. *Journal of Applied Physics (USA)*, 66(7): 2962-2967 (1 Oct 1989). DOE Contract W-7405-ENG-48.

Platinum metal was shock compressed to 660 GPa using a two-stage light-gas gun to qualify this material as an ultrahigh-pressure standard for both dynamic and static experiments. The shock velocity data are consistent with most of the previously measured low-pressure data, and an overall linear $u_s - u_p$ relationship is found over the range 32–660 GPa. As a part of this work, we have also extended the Hugoniot of the tantalum standard we use to 560 GPa; we have included these data into a new linear fit of the tantalum Hugoniot between 55–560 GPa. We also present the results of a first-principles theoretical treatment of compressed platinum. The fcc phase is predicted to remain stable to beyond 550 GPa. In addition, we have calculated the 300-K pressure-volume isotherm and the Hugoniot. The latter is in excellent agreement with experimental results and qualifies the former to at least 10% accuracy.

807 Perturbed angular correlation study of impurity interactions in a cubic host metal: Hf in Nb. Warnes, W.H. (Department of Physics and Advanced Materials Research Center, Oregon State University, Corvallis, Oregon 97331 (US)); Gardner, J.A. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4276-4280 (1 Sep 1989).

^{181}Ta perturbed angular correlation experiments have been performed on Nb-Hf alloys containing 0.5–5.5 at. % Hf. A Maxwellian frequency distribution model is proposed to account for the electric-field-gradient distribution due to impurities in a cubic matrix. The model was used to analyze the Nb-Hf data. If an unperturbed fraction is included with the Maxwellian distribution, then agreement with experiment is excellent. The unperturbed site is apparently required to correct for underestimation of the actual distribution by the Maxwellian at low frequencies. The unperturbed fraction is large only for small impurity concentrations and corresponds approximately to sites more distant than five lattice spacings from the nearest impurity. The peak of the Maxwellian quadrupole frequency distribution is linear in Hf concentration.

808 Paramagnetic neutron scattering from Pd_2MnSn. Graf, H.A. (Hahn-Meitner Institut, D-1000 Berlin 39, Federal Republic of Germany (DE)); Boni, P.; Shirane, G.; Kohgi, M.; Endoh, Y. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4243-4248 (1 Sep 1989).

Paramagnetic neutron scattering spectra from the localized ferromagnet Pd_2MnSn have been reexamined at T=210 K ($1.1T_C$), primarily at large-q values. The measured profiles are compared with theoretical profiles calculated according to the three-pole approximation theory from the magnetic exchange constants up to the sixth-nearest-neighbor shell. The calculated linewidths agree reasonably with the observed widths, but not the line shapes; the data show no indication of side peaks at finite energy, as predicted by the theory for the higher-q values. The measurements can be fitted well, however, by a parametrized spectral weight function based on the three-pole approximation.

809 Magnetic behavior of $Ce(Cu_{1-x}Ag_x)_6$. Fraunberger, G. (Department of Physics, University of Florida, Gainesville, Florida 32611 (US)); Andraka, B.; Kim, J.S.; Ahlheim, U.; Stewart, G.R. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4735-4739 (1 Sep 1989).

We have investigated doped $CeCu_6$ via x-ray diffraction, dc and ac susceptibility, and specific heat in zero and applied magnetic field with a primary focus on the magnetic behavior caused by Ag doping. We present evidence from bulk specific heat and metallography data that the limit of Ag solubility in $Ce(Cu_{1-x}Ag_x)_6$ is $x \sim 0.1$. Data below the magnetic ordering temperature may be fit to an exponential temperature dependence, implying a weak-coupled energy gap of $\Delta = 0.58$ K, contradicting an earlier report that C behaves linearly with temperature with a γ over 3 J/mol K^2 in the ordered state. Comparisons to magnetically ordered, doped UPt_3 are made.

810 Theoretical construction of the magnetic Hamiltonian and zero-temperature anisotropic energy in $Nd_2Fe_{14}B$. Zhong, X. (Department of Physics, University of Missouri-Kansas City, Kansas City, Missouri 64110 (US)); Ching, W.Y. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 5292-5295 (1 Sep 1989).

The magnetic Hamiltonian of $Nd_2Fe_{14}B$ at the Nd site has been constructed using a first-principles approach based on the energy-band results. The crystal-field parameters are evaluated using the real-space charge-density distribution and the exchange field is obtained by applying an approximate Stoner model to the spin-polarized density of states. The calculated stabilization energy is in good agreement with the experimental measurement. It is also shown that the exchange field predominates in the magnetic Hamiltonian but the fourth-order and second-order off-diagonal crystal-field terms are not entirely negligible.

811 Photoelectron diffraction determination of the geometry of a clean metal surface: Ta(100). Bartynski, R.A. (Department of Physics and Astronomy, Rutgers University, P.O. Box 849, Piscataway, New Jersey 08855-0849 (US)); Heskett, D.; Garrison, K.; Watson, G.M.; Zehner, D.M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5340-5343 (15 Sep 1989). DOE Contract AC02-76CH00016.

The ratio of photoemission intensities from the bulk- and surface-shifted 4*f* core levels of the clean Ta(100) surface was measured in two different modes: as a function of photon energy at normal emission and as a function of polar angle near the [011] azimuth at $\hbar\omega = 65$ eV. We have also performed a multiple-scattering photoemission calculation for several first interlayer spacings ranging from the bulk value to a 15% contraction. The best agreement with experiment was obtained for a (10 ± 5)% contraction of the first interlayer spacing.

812 Covalent bonding of sulfur on Ni(001): S as a prototypical adsorbate catalytic poisoner. Fu, C.L. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208 (US)); Freeman, A.J. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5359-5362 (15 Sep 1989). DOE Contract AC05-84OR21400.

The effects of sulfur, as a prototypical catalytic "poisoner," on the structural, electronic, and magnetic properties of Ni(001) are investigated with the highly precise full-potential linearzed augmented-plane-wave method. The Si-Ni interlayer distance is determined to be 1.36 A. The poisoning is found to be caused by local Ni-S covalent-bond formation and the "lone-pair" density polarization on the S site. A nearly magnetically dead Ni surface layer ($0.12\mu_B$) is obtained. The indirect long-range (screening) interaction is manifested in a layer-dependent oscillatory on-site charge transfer between e_g and t_{2g} symmetry states for Ni inner layers.

813 Charge transfer in intermetallics: $HfPt_3$. Wertheim, G.K. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974 (US)); Buchanan, D.N.E.; Wernick, J.H. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5319-5324 (15 Sep 1989).

The charge transfer in $HfPt_3$ is discussed on the basis of the 4*f* core-electron binding-energy shifts of the constituent elements. Based on binding energies measured relative to the Fermi levels, both Hf and Pt have positive shifts in the compound. According to a Born-Haber cycle analysis these shifts are directly attributable to the large enthalpy of formation of $HfPt_3$. Corrections for the differences in reference level and final-state screening between the element and the compound make the shift of the Hf larger and that of the Pt smaller, and presumably negative, indicating a net flow of electronic charge from Hf to Pt. This is in accord with expectations based on the electronegativity difference and with the semiempirical model of Miedema *et al.*, but counter to the direction of charge flow in the Engel-Brewer analysis of bonding.

814 Dissociation of O_2 on Cu(001). Fischer, C.R. (Department of Physics, Queens College of The City University of New York, Flushing, New York 11367-0904 (US)); Whitten, J.L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5745-5749 (15 Sep 1989).

A preliminary study of dissociation pathways for O_2 near a Cu(001) surface is reported. Self-consistent-field and configuration-interaction calculations are carried out on a nine-atom monolayer model of the copper lattice. Two low-energy pathways for the approach of O_2 toward the surface are found, each of which involves one O atom atop a Cu atom. The first corresponds to the O-O axis parallel to the surface, and the second to the O-O axis at angle to the surface followed by a rotation to make it parallel. The latter involves an energy barrier to rotation. Asymmetric stretch of O_2 leads to dissociation with no additional barrier. The energetics and electronic structure of points along the dissociation pathway are described.

815 Epitaxial growth of body-centered-tetragonal copper. Li, H. (College of Engineering and Applied Science, State University of New York, Stony Brook, New York 11794 (US)); Wu, S.C.; Tian, D.; Quinn, J.; Li, Y.S.; Jona, F.; Marcus, P.M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5841-5844 (15 Sep 1989).

Deposition of Cu in ultrahigh vacuum on a clean Pd{001} surface leads to the growth of a new crystalline Cu phase with body-centered-tetragonal (bct) structure well ordered up to about 10 layers. A low-energy electron-diffraction (LEED) analysis of 6-layer films finds the bulk lattice parameters to be $a = 2.75$ A and $c = 3.24$ A, with little relaxation of the surface layers. Photoemission experiments confirm that the grown phase is different from the stable fcc modification and show a surface state 4.8 eV below the Fermi energy which is not present in fcc Cu. The grown phase may correspond to a theoretically predicted bct phase under slight strain, but we also show directly that it is probably strained bct and not strained bcc or fcc.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 10, 755, 757, 766, 769, 785, 792, 795, 796, 797, 995, 1010, 1011, 1016, 1063, 1071, 1851, 1853, 1868, 1869, 1870, 1873, 1874

816 (AD-A-209770/7/XAB) **Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989.** Armini, A.J.; Bunker, S.N. Implant Sciences Corp., Danvers, MA (USA). Jun 1989. 34p. Available from NTIS, PC A03/MF A01.

This report explores the use of ion-implantation techniques to form solid lubricating surfaces on all ceramic (silicon nitride) and hybrid ball bearings. Techniques were developed to implant and/or coat silicon nitride and 52100 bearing steel with MoS_2, boron, and tin ion beams. A friction/wear tester was also developed to evaluate these coatings in both air and dry nitrogen atmospheres. Friction test results have yielded durable films on both silicon nitride and 52100 steel that exhibit friction coefficients less than 0.1 in a dry state. Oil-lubricated controls in a hybrid bearing also show 0.1. Other dry film processes developed have exhibited ultra-low friction (0.02 to 0.05), but these films had limited lifetime. The dry films are fairly durable and adherent but more work is needed to further improve the durability and adapt the coating process to coating complicated shapes such as balls and rings. (JES)

817 (AD-A-210149/1/XAB) **Metal oxide films from carboxylate precursors.** Davison, W.W.; Shyu, S.G.; Roseman, R.D.; Buchanan, R.C. Illinois Univ., Urbana, IL (USA). Advanced Construction Technology Center. 1988. 11p. (ACTC-89-03-01). Available from NTIS, PC A03/MF A01.

Pub. in Materials Research Society Symposium Proceedings, Vol. 121, 797-803(1988).

Zirconium oxide and $Ba_2YCu_3O(7-X)$ metal oxide films were prepared from carboxylate precursors. The zirconia films were prepared from Zirconium octoate and the Ba-Y-Cu-O compound synthesized from a mixture of the metal neodecanoates. Dense, adherent ZrO_2 films were obtained on silicon. Dense, superconducting

Ba-Y-Cu-O films were also fabricated utilizing the octoate-derived ZrO_2 as a bonding surface and diffusion buffer. Preparation methods for thin oxide films using metal carboxylate precursors have been demonstrated. Favorable superconducting properties were obtained with the (1,2,3) film deposited on the ZrO_2/Si films, showing ZrO_2 to an effective diffusion barrier.

818 (AGARD-CP-449, pp. 10) **The demonstration of monolithic and composite ceramics in aircraft gas turbine combustors.** Davis, F.G.; Hudson, D.A. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

Since the mid seventies, the Air Force Wright Aeronautical Laboratories Aero Propulsion Laboratory has been on a course to evaluate and demonstrate the application of advanced non-metallic materials in experimental gas turbine engines. Potential increases of several hundred degrees or more in operating temperature represents a quantum leap in engine capability. Since the seventies, combustion rig tests have been successfully performed at near-stoichiometric conditions on two ceramic combustor configurations. These combustors were annular, through-flow designs similar to the metallic burners used in present-day military propulsion gas turbines. The first configuration used monolithic ceramic segments as a portion of the inner and outer combustor liners. The segments were supported by an external metal structure. These segments were fabricated from silicon carbide material. In the most recent program ceramic composite rings were used to form the inner and outer liners. The rings were composed of silicon carbide fibers and a silicon carbide matrix. The ceramic composite rings required no external support structure. Testing consisted of both steady-state and transient operations. During transient testing, the combustors were subjected to rapid thermal cycling. Testing of silicon carbide and silicon nitride ceramic materials has just begun.

819 (CONF-890468–13) **Nucleation and growth mechanisms in ion-plated TiN films on steel substrates.** Erdemir, A.; Cheng, C.C. Argonne National Lab., IL (USA). 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 16. international conference on metallurgical coatings and equipment exhibit; San Diego, CA (USA); 17-21 Apr 1989. Order Number DE90002269. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cross-sectional transmission electron microscopy (XTEM) was used to investigate the nucleation and growth characteristics of TiN films, ion plated on tool and stainless steel substrates with and without an α-Ti underlayer ($\approx$100 nm thick). It was found that (1) at lower deposition temperatures, the underlayer α-Ti remains unchanged and exhibits a layer + island growth mode; (2) at higher deposition temperatures, the underlayer may transform into a TiC phase on M50 steel and into a δ'-TiN phase on 316L stainless steel; (3) the growth behavior of TiN films was controlled primarily by the reaction thermodynamics and diffusion kinetics of Ti and N adatoms. Based on microscopic evidence together with the kinetic and thermodynamic considerations a mechanistic model is presented to describe the nucleation and growth mechanisms of ion-plated TiN films under the deposition conditions explored in this study. 20 refs., 4 figs.

820 (CONF-890468–14) **Correlation of interface structure with adhesive strength of ion-plated TiN hard coatings.** Cheng, C.C.; Erdemir, A.; Fenske, G.R. Argonne National Lab., IL (USA). [1989]. 22p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 16. international conference on metallurgical coatings and equipment exhibit; San Diego, CA (USA); 17-21 Apr 1989. Order Number DE90002265. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Interlayers of Ti have been used to improve the adhesion of ion-plated TiN coatings. However, the mechanisms of the improvement of adhesion remain unclear. In this study, we have applied analytical electron microscopy on cross section specimens and Auger electron spectroscopy to investigate the correlation of the interface structure with the scratch adhesion of ion-plated TiN coatings with and without Ti interlayers on M50 steel substrates. Our results have shown that the Ti interlayer can reduce the internal stresses at the interface region. Furthermore, this Ti interlayer can transform into TiC phase at high substrate temperature both during and after ion plating. These types of treatment can in turn increase the adhesion of the TiN coatings via a better interface contact and stronger chemical bonds. 16 refs., 7 figs., 1 tab.

821 (CONF-890480–3) **Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system.** Pei, S.Y.; Jorgensen, J.D.; Hinks, D.G.; Dabrowski, B.D.; Richards, D.R.; Mitchell, A.W.; Sinha, S.K.; Vaknin, D.; Newsam, J.M.; Jacobson, A.J. Argonne National Lab., IL (USA). Jul 1989. 9p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. From Conference on oxygen disorder effects in high T_c superconductors; Trieste (Italy); 18-21 Apr 1989. Order Number DE90002264. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this article we present a brief report of recent work carried out to elucidate the phase diagram of the $Ba_{1-x}K_xBiO_3$ system. A full account of this investigation will be published shortly. The recently discovered "high-T_c" superconductor $Ba_{1-x}K_xBiO_3$ is unique in the sense that unlike the other high-T_c superconductors, it does not contain CuO_2 planes and is cubic rather than layered in structure. It does, however, exhibit a series of structural phase transitions as a function of both K concentration x and temperature. Superconductivity occurs only in a cubic phase and disappears abruptly at $x \leq 0.4$ where the behavior apparently becomes non-metallic. Few details have been available hitherto of the structural phases found as x is decreased, and some of the reported results are not consistent with each other. The present measurements were carried out on the H4S triple axis spectrometer at Brookhaven's High Flux Reactor and on the Special Environment Powder Diffractometer (SEPD) at Argonne's Intense Pulsed Neutron Source. 19 refs., 3 figs.

822 (CONF-890971–3) **Microstructure and electrical properties of bulk high-T_c superconductors.** Balachandran, U.; McGuire, M.J.; Goretta, K.C.; Youngdahl, C.A.; Shi, Donglu; Danyluk, S.; Poeppel, R.B. Argonne National Lab., IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Conference on superconductivity and applications; Buffalo, NY (USA); 19-21 Sep 1989. Order Number DE90001762. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Bulk forms of the superconductors Y-Ba-Cu-O and Bi-Sr-Ca-Cu-O generally have a low critical current density (J_c). At 77 K in zero magnetic field, values greater than about 10^3 A cm^{-2} have seldom been obtained. The most notable exceptions are for melt-textured rods and filaments, for which J_c values often exceed 10^4 A cm^{-2}. Values of J_c approaching 10^4 A cm^{-2} have also been reported for wires and tapes processed in Ag tubes. Little information about the microstructures of these composite conductors has emerged. This work was undertaken to examine the relationships between processing, microstructure, and electrical properties for high-temperature superconductors processed as pellets or Ag-clad tapes. 15 refs., 5 figs., 1 tab.

823 (CONF-890971–4) **$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects.** Dabrowski, B.; Jorgensen, J.D.; Hinks, D.G.; Pei, Shiyou; Richards, D.R.; Vandervoort, K.G.; Crabtree, G.W.; Vanfleet, H.B.; Decker, D.L. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. STC-8809854. From Conference on superconductivity and applications; Buffalo, NY (USA); 19-21 Sep 1989. Order Number DE90001988. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The structural, superconducting and normal-state properties of $La_2MO_{4+\delta}$ (M = Cu, Ni, Co) were studied by neutron powder diffraction, thermogravimetric analysis and resistivity measurements. $La_2CuO_{4+\delta}$ was found to undergo phase separation near room temperature into antiferromagnetic La_2CuO_4 and superconducting $La_2CuO_{4.08}$. Single-phase, metallic, superconducting $La_2CuO_{4.08}$ was prepared under 25 kbar of O_2 at 500°C. The excess oxygen present as $O^=$ ions provides a doping mechanism analogous to alkaline-earth metal ion substitution. $La_2NiO_{4+\delta}$ and $La_2CoO_{4+\delta}$ undergo a similar phase separation for $0.02<\delta<0.12$ and $0<\delta<0.16$,

respectively. The structure of the interstitial excess oxygen defect was determined for a single-phase $La_2NiO_{4.18}$ sample. A different excess oxygen defect forms for material with $0 \leq \delta \leq 0.02$. All stoichiometric (δ=0) compounds have the same Cmca orthorhombic structure and are semiconducting and antiferromagnetic. 17 refs., 6 figs.

824 (CONF-891116–1) **Empirical and analytical determination of the fracture resistance of a TiB_2 particle/SiC matrix composite.** Jenkins, M.G.; Taya, M.; Kobayashi, A.S.; Salem, J. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From First international SAMPE symposium and exhibition on new materials and processes for the future; Chiba (Japan); 28 Nov - 1 dec 1989. Order Number DE89012331. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The addition of TiB_2 particles to an SiC matrix improves machinability and the room temperature fracture resistance of the composite. Empirical tests have revealed, that the fracture resistance of this composite is a function of both loading condition (monotonic or cyclic-type) and temperature (20° to 1400°C) with some dependence on specimen geometry (DCB or CNFB). Both K_{IC} and the levels of the flat R-curves decrease with increasing temperature and are dependent on the loading condition. Fractography shows that 'toughening' contributions include particle size effects, micro-cracking at the particle/matrix interface, and crack deflection. Analytical modeling based on the residual stresses within the material due to the thermal mismatch between the particle and matrix materials compares well with the empirical results. 12 refs., 9 figs., 3 tabs.

825 (EGG-MS–8696) **Superconducting film fabrication by the sol-gel process.** Debsikdar, J.C.; Samsel, E.G.; Sellers, C.H.; Telschow, K.L.; Miley, D.V. EG and G Idaho, Inc., Idaho Falls, ID (USA). Sep 1989. 42p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. Order Number DE90002069. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A sol-gel approach based on polymerization chemistries of alkoxide precursors was used to produce yttrium barium cuprate ($YBa_2Cu_3O_{7-x}$) superconducting films. The alkoxide precursors were also synthesized at the INEL either because they were not commercially available or because the available alkoxides were not suitable for sol-gel synthesis. It has been demonstrated that the chemical homogeneity of sol-gel derived $YBa_2Cu_3O_{7-x}$ is superior to that produced by the conventional solid state chemistry approach, even though both powders appeared to be "single phase" $YBa_2Cu_3O_{7-x}$ by x-ray diffraction analysis. Superconducting thin films were fabricated from partially polymerized alkoxide solution on polycrystalline and single crystal substrates. The characteristics of these films have been reported. The precursor solution used for thin film fabrication produced a paste-like viscous, stable fluid which could be used as a potential material for fabricating superconducting fiber and/or wire. 17 refs., 31 figs.

826 (KFK–4601) **Epitaxial growth and properties of YBaCuO thin films.** Geerk, J.; Linker, G.; Meyer, O. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik. Aug 1989. 99p. Order Number DE90718101. Available from NTIS (US Sales Only), PC A05/MF A01.

The growth quality of YBaCuO thin films deposited by sputtering on different substrates (Al_2O_3, MgO, $SrTiO_3$, $Zr(Y)O_2$) has been studied by X-ray diffraction and channeling experiments as a function of the deposition temperature. Besides the substrate orientation, the substrate temperature is the parameter determining whether films grow in c-, a-, (110) or mixed directions. Epitaxial growth correlates with high critical current values in the films of up to 5.5×10^6 A/cm^2 at 77 K. Ultrathin films with thicknesses down to 2 nm were grown revealing three-dimensional superconducting behaviour. Films on (100) $SrTiO_3$ of 9 nm thickness and below are partially strained indicating commensurate growth. From the analysis of the surface disorder 1 displaced Ba atom per Ba_2Y row was obtained indicating that the disordered layer thickness is about 0.6 nm. Tunnel junctions fabricated on these films reveal gap-like structures near +-16 mV and +-30 mV. (orig.).

827 (LA–11592-T) **Synthesis and characterization of VLS [vapor-liquid-solid] silicon carbide whisker reinforced reaction bonded silicon nitride.** Gac, F.D. Los Alamos National Lab., NM (USA). c Oct 1989. 235p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-36. Available from Frank David Gac, Los Alamos National Laboratory, Los Alamos, NM 87545.

Four different types of vapor-liquid-solid (VLS) SiC whiskers were added to a reaction bonded silicon nitride (RBSN) matrix in levels of 4, 8, and 17 vol%. Each whisker type represented a distinct surface treatment: as-beneficiated, oxidized in air at 1000°C for one hour, carbon coated and boron nitride (BN) coated. The tensile strength of the carbon coated whiskers was not affected by the coating process, whereas the oxidation and BN coating treatments reduced the strengths of the whiskers. A correlation was observed between the mechanical performance of the composites and the degree of degradation experienced by the different whisker types during nitridation of the RBSN matrix composite. 119 refs., 43 figs., 22 tabs.

828 (N–89-17668) **Dynamic porosity variations in ceramics.** Generazio, E.R.; Stang, D.B.; Roth, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Dec 1988. 7p. (NASA-TM–101340;E–4358;NAS–1.15:101340). Available from NTIS, PC A02/MF A01.

A silicon carbide disk was sintered from 2090 to 2190 C in 25 C steps. After each sintering step the disk was examined using a precision acoustic scanning system to determine acoustic attenuation and velocity. The bulk density was found to vary nonmonotonically with sintering temperature. During the sintering process, the density varied as much as 10 pct from its value at 2090 C. Local density fluctuations were observed to occur in an organized and history-dependent way. These local density fluctuations varied up to + or - 7 pct of the bulk density and were made visible by acoustic attenuation and velocity mapping.

829 (N–89-18550) **MATE program: erosion resistant compressor airfoil coating, volume 2. Final report.** Freling, M. Pratt and Whitney Aircraft, East Hartford, CT (USA). Mar 1987. 22p. (NASA-CR–179645;NAS–1.26:179645;PW–5574-212-VOL-2). Available from NTIS, PC A03/MF A01.

The performance of candidate erosion resistant airfoil coatings installed in ground tested experimental JT8D and JT9D engines and subjected to cyclic endurance at idle, takeoff and intermediate power conditions has been evaluated. Engine tests were terminated prior to the scheduled 1000 cycles of endurance test due to high cycle fatigue fracture of the Gator-Gard plasma sprayed 88WC-12Co coating on titanium alloy airfoils. Coated steel (AMS5616) and nickel base alloy (Incoloy 901) performed well in both engine tests. Post test airfoil analyses consisted of binocular, scanning electron microscope and metallographic examinations.

830 (N–89-23678) **Preparation and evaluation of silicon nitride matrices for silicon nitride-SiC fiber composites. M.S. Thesis Final Technical Report.** Axelson, S.R. Alfred Univ., NY (USA). Feb 1988. 63p. (NASA-CR–184798;NAS–1.26:184798). Available from NTIS, PC A04/MF A01.

Continuous silicon carbide (SiC) fiber was added to three types of silicon nitride (Si_3N_4) matrices. Efforts were aimed at producing a dense Si3N4 matrix from reaction-bonded silicon nitride (RBSN) by hot-isostatic-pressing (HIP) and pressureless sintering, and from Si_3N_4 powder by hot-pressing. The sintering additives utilized were chosen to allow for densification, while not causing severe degradation of the fiber. The ceramic microstructures were evaluated using scanning optical microscopy. Vickers indentation was used to determine the microhardness and fracture toughness values of the matrices. The RBSN matrices in this study did not reach more than 80 percent of theoretical density after sintering at various temperatures, pressures, and additive levels. Hot-pressing Si_3N_4 powder produced the highest density matrices; hardness and toughness values were within an order of magnitude of the best literature values. The best sintering aid composition chosen included Y_2O_3, SiO_2, and Al_2O_3 or AlN. Photomicrographs demonstrate a significant reduction of fiber attack by this additive composition.

831 (ORNL/FTR–2954) **[Application of electron microscopy for the analysis of the mechanical behavior of advanced ceramics]: Foreign trip report, June 3, 1988–June 13,**

1988. Tennery, V.J.; Bullington, V.R. Oak Ridge National Lab., TN (USA). 11 Jul 1988. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001747. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The travelers attended the 33rd ASME International Gas Turbine and Aeroengine Congress and Exposition. V.R. Bullington staffed the exhibits for the Ceramic Technology for Advanced Heat Engines Project and distributed informational materials to the attendees. V.J. Tennery presented a paper; in addition, he organized and presented the US portion of a technical status review for the Executive Committee, IEA Annex II (including US research being conducted within the IEA Annex II agreement on advanced structural ceramics). Finally, Dr. Tennery made a technical presentation on the proposed research plan for an Annex III agreement on structural ceramics.

832 (ORNL/FTR–3066) **[Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988.** Bleier, A. Oak Ridge National Lab., TN (USA). 26 Sep 1988. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002138. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Society of Chemical Industry (SCI) symposium and technical discussions conducted during the visit to Imperial Chemical Industries (ICI) afforded the traveler the opportunity to gain insight into recent scientific and industrial advances in England, The Netherlands, Yugoslavia, Poland, Canada, West Germany, and the United States regarding particulate deposition processes and the detailed interactions between dissimilar particles and substrates. Discussions were held with various researchers on the role of polymeric additives in controlling particle-particle and particle- substrate interactions and the rheological behavior of composite ceramic slurries that contain binder. Researchers expressed interest in the scientific mechanism, described by the traveler in this invited lecture, by which interactions between dissimilar ceramic particles can be controlled in concentrated slurries.

833 (ORNL/FTR–3096) **[Surface modification of metals by ion beams]: Foreign trip report, August 24, 1988–October 11, 1988.** McHargue, C.J. Oak Ridge National Lab., TN (USA). 20 Oct 1988. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001285. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler acted as Co-Organizer and Director of the NATO-ASI Structure-Property Relationships in Surface-Modified Ceramics and delivered two tutorial lectures. The Institute focused on the effects of ion beam treatments in ceramics that arise from the structure and bonding in this class of materials that are different from those in metals and semiconductors. An up-to-date-assessment of the status of this research was made, and needs and opportunities for further research were identified. An invited paper, "Ion Implanted Ceramics," was presented at the international meeting on Surface Modification of Metals by Ion Beams '88 held in Riva del Garda, Italy. Much of the emphasis of this meeting has shifted to ion beam assisted deposition. The visits to the three universities was for the purpose of analyzing data obtained in collaborative research between the traveler and researchers at each institution. Further studies were planned.

834 (ORNL/FTR–3097) **[Ceramic powder characterization]: Foreign trip report, October 7–14, 1988.** Tennery, V.J. Oak Ridge National Lab., TN (USA). 20 Oct 1988. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90001282. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended the conference, "2nd International Conference on Ceramic Powder Processing Science," and participated in the Subtask 2 working group meeting on ceramic powder characterization being conducted by the United States, the Federal Republic of Germany (FRG), and Sweden under terms of the Annex II agreement. In addition, the traveler participated in an unscheduled meeting with Dr. R. Neumann, KFA, Juelich, FRG, and Dr. A. Bruechner-Foit, KFK, University of Karlsruhe, FRG, to review major problems encountered in receiving mechanical property data from the FRG under Subtask 4 of the Annex.

835 (ORNL/FTR–3156) **[7th international conference on ceramics]: Foreign trip report, December 12–18, 1988.** Becher, P.F. Oak Ridge National Lab., TN (USA). 3 Jan 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002144. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The 7th International Conference on Ceramics addressed current research in the fields of ceramic composites, electronic and superconducting ceramics, and ceramic processing. Technical papers by researchers from western and eastern Europe, Asia (including Japan and China), Australia, and the United States were presented. The traveler presented an invited lecture on the analysis of the toughening behavior in whisker reinforced ceramics and their mechanical properties.

836 (ORNL/Sub–86-57444/01) **A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C.** Wright, I.G.; Colwell, J.A. Oak Ridge National Lab., TN (USA); Battelle Columbus Labs., OH (USA). 15 Sep 1989. 92p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. 86X-57444. Order Number DE90001277. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

In this literature review, the state of understanding of the effects of microalloying additions on the behavior of protective oxide scales is examined, with particular emphasis on scale formation and degradation at temperatures in the range 500-700°C, and in environments ranging from simple oxidation to those involving complex gas mixtures and mechanical components. 143 refs., 15 figs.

837 (UCRL–100792) **Micro-scale simulation of dynamic compaction of oxide and metal powder mixture.** Kamegai, M.; Walton, O.R.; Taylor, A.G. Lawrence Livermore National Lab., CA (USA). 2 Oct 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890812–60: American Physical Society topical conference on shock compression of condensed matter, Albuquerque, NM (USA), 14-17 Aug 1989). Order Number DE90002220. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Many features of the dynamic compaction of powders are potentially favorable for use in processing high-T_c oxide superconductors. Conventional sintering methods tend to produce unwanted impurities, voids, and oxygen-deficient grain boundaries and have, thus, failed to form bulk oxide superconductors with high critical current. One proposed approach for a dynamic process is to compress a mixture of high-purity single-crystallite particles and fine silver particles. Computer modeling of dynamic compaction has thus far been limited to bulk simulation of the process by continuum mechanics codes. Results of compaction experiments are not reliably predicted with such techniques because the micro-scale dynamics of powder compaction are only modeled by phenomenological approximation. We are developing a micro-scale simulation technique in which we apply computer models similar to those of molecular dynamics, which were originally designed to simulate the flow behavior of inelastic, frictional particles. In this method, the oxide grain is represented by a nearly elastic sphere while an individual silver grain is modeled by an aggregate of effective inelastic-frictional particles bound by a prescribed interparticle force. In this paper, we compare our first two-dimensional simulation results for a simple configuration (a single aggregate silver grain crushed between two nearly elastic ceramic spheres) with our continuum calculations for the same configuration. This micro-scale simulation technique can be extended to study an assembly of dissimilar grains in three-dimensional space. 17 refs., 8 figs., 3 tabs.

838 **Hydrogen dissolution in and release from nonmetals.** Sherman, D.F. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.); Olander, D.R. *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 166(3): 307-320 (Aug 1989).

A technique was developed for measurement of the solubility and release kinetics of hydrogen in refractory nonmetals. Uranium dioxide specimens were saturated with hydrogen in a high-pressure furnace at pressures between 5 and 30 atm and temperatures from 1200 to 1600°C. Release was accomplished in a separate vacuum

extraction apparatus in which the specimen was subjected to a linear temperature ramp. Mass spectrometric detection of the released hydrogen had a sensitivity of ≃2 ng/h. The equilibrium H/U ratios of hydrogen in single-crystal UO_2 were between $1x10^{-6}$ and $3x10^{-5}$ with an apparent heat of solution of 235 kJ/mol. Sievert's law was obeyed. The solubilities of hydrogen in stoichiometric polycrystalline UO_2 were about 10 times larger than in the single crystal, and in polycrystalline UO_{2-x}, about 100 times larger. The hydrogen desorption curves showed multiple peaks, which could not be explained by a simple diffusion mechanism. The kinetics were modeled as first or second order detrapping processes. (orig.).

839 **Dislocation mechanisms, diffusional processes and creep behavior in NbC_{chl}.** Chevacharoenkul, S. (North Carolina Univ., Chapel Hill, NC (USA)); Davis, R.F. *Acta Metallurgica (USA),* 37(2): 417-428 (Feb 1989).

A brittle-ductile transition occurs around 1373 K in NbC_{chl} as a result of the increase in the character of the bonding with increasing temperature. Steady-state creep in NbC_{chl} between 1373 and 1573 K occurs by dislocation glide to form equiaxed cell structures; it is controlled by the unlocking of dislocation interactions within the cell walls. Between 1573 and 1873 K, the kinetic data indicate a transition from dislocation glide to dislocation climb as the rate controlling creep process. Above 1873 K, subboundary formation, and polygonization confirms that dislocation glide and climb are occurring during creep. The activation energy values for creep in this temperature range are consistent with niobium lattice diffusion as the rate controlling mechanism.

840 **High-temperature precipitation hardening of Y_2O_3 partially-stabilized ZrO_2 (Y-PSZ) single crystals.** Heuer, A.H. (Case Western Reserve Univ., Cleveland, OH (USA)); Lanteri, V.; Dominguez-Rodriguez. *Acta Metallurgica (USA),* 37(2): 558-568 (Feb 1989).

Precipitation hardening in two-phase 4.5 m/o Y_2O_3 partially-stabilized ZrO_2 (Y-PSZ) single crystals has been studied at 1400°C, using crystals at 1600°C for various times up to 150 h. The aging allowed the formation and growth of low-solute tetragonal (t)-ZrO_2 precipitates in a high-solute cubic (c)-ZrO_2 solid solution matrix. These "colony" precipitates are internally twinned on {110}, and form fiber-like morphologies (fiber axis along <001>) at the longest annealing times; the lamellar spacing within the colonies coarsens via conventional Ostwald ripening. Surprisingly, even large precipitates (> 1μm long) are coherent. All crystals deformed by nucleation and propagation of Luders bands, leading to serrated flow. The yield stress increases linearly with lamellar spacing and reaches the very high value of 550 MPa (at 1400°C) for the 150 h sample. The particular dislocation-precipitate interactions leading this exceptionally potent precipitation hardening are discussed.

841 **Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides.** Ullman, J.E. (Ames Laboratory and Department of Materials Science and Engineering, Iowa State University, Ames, Iowa 50011 (US)); McCallum, R.W.; Verhoeven, J.D. *Journal of Materials Research (USA),* 4(4): 752-754 (Jul 1989). DOE Contract W-7405-ENG-82.

In the processing of the high temperature superconductors $RE_1Ba_2Cu_3O_{7-x}$, a knowledge of the liquidus temperatures is required in order to avoid liquid formation during the initial reactions of the starting materials. We have investigated the invariant points on the liquidus surface of the RE-Ba-Cu-O systems for RE=Y, Er, Gd, and Nd in oxygen, air, and argon. While the temperatures of the low melting reactions are almost independent of the rare earth species, they are heavily dependent on oxygen partial pressure. In addition, the peritectic decomposition temperature of the $REBa_2Cu_3O_7$ phase was found to be a function of rare earth with a significantly higher value for the Nd compound than for the other rare earths.

842 **Environmental effects on luminescence yield of superconducting $YBa_2Cu_3O_x$.** Jahan, M.S. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Cooke, D.W.; Sheinberg, H.; Smith, J.L.; Lianos, D.P. *Journal of Materials Research (USA),* 4(4): 759-762 (Jul 1989).

Gamma-ray-induced surface defects in $YBa_2Cu_3O_x$ ($x\approx7$) have been investigated by thermally stimulated luminescence (TSL) following storage of the samples in dry (vacuum), oxygen, and 98% relative humidity environments. Irradiation of samples stored in either vacuum or oxygen environments shows that no insulating chemical species are formed on the surface of the superconductor. In contrast, exposure to the humid environment produces various chemical components on the surface, and, consequently, enhances the TSL yield. Comparison of the $YBa_2Cu_3O_x$ TSL glow curve and emission spectra with those of $BaCO_3$ suggests that one of the components contributing to the purported $YBa_2Cu_3O_x$ luminescence is $BaCO_3$. Evidence for formation of other chemical species and the suitability of the TSL technique for their determination are discussed.

843 **Formation of coherent twins in $YBa_2Cu_3O_{7-\delta}$ superconductors.** Jou, C.J. (Department of Materials Science and Mineral Engineering, University of California, and Center for Advanced Materials, Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, California 94720 (US)); Was *Journal of Materials Research (USA),* 4(4): 795-801 (Jul 1989). DOE Contract AC03-76SF00098.

A nucleation-and-growth mechanism for the twin formation in $YBa_2Cu_3O_{7-\delta}$ superconductors based on the oxygen uptake rate curve and published transmission electron microscopic observations is proposed together with an oxygen-depleted twin boundary model. The difficulty of reaching stoichiometric $YBa_2Cu_3O_7$ is explained.

844 **Characterization and superconducting properties of phases in the Bi-Sr-Cu-O system.** Chakoumakos, B.C. (Oak Ridge National Laboratory, Solid State Division, Oak Ridge, Tennessee 37831-6056 (US)); Ebey, P.S.; Sales, B.C.; Sonder, E. *Journal of Materials Research (USA),* 4(4): 767-780 (Jul 1989). DOE Contract AC05-84OR21400.

Phase formation in the system Bi-Sr-Cu-O has been examined as a function of composition, temperature, ambient atmosphere, cooling history, and annealing time. Ceramic processing and melt crystallization techniques were used. For the ceramic materials (using Bi_2O_3, $SrCO_3$, and CuO) processed at 700°C in air the $Bi_2Sr_2O_6$ composition (221) crystallizes to a mixture of CuO, $SrCO_3$, and the rhombohedral Bi_2O_3. *x*SrO solid solution. At 800–830°C in air for short durations (5 min to 2 h) the reacted products consist principally of the ideal 221 phase with minor amounts of CuO. For longer reaction times (2–400 h) the reacted products consist of the ideal 221-type structure with *c*=24.64 A and *a*=3.804 A, a "collapsed" 221 structure with *c*=23.6 A, and CuO. With increasing reaction time the "collapsed" 221 phase grows gradually at the expense of the ideal 221 phase. The "collapsed" 221 phase is not an oxycarbonate and appears to be a distinct ternary compound near the 221 composition, with a layered structure having a 1 A smaller stacking repeat. The ideal 221 phase is a solid solution with variable Sr content. With decreasing Sr in the starting mixture [2 to 1.25 atoms per formula unit (afu)] we observe the following: (1) the formation of the "collapsed" 21 structure is inhibited; (2) for the ideal 221 phase of *c*-cell dimension decrease significantly (0.2 A) and the *a*-cell dimension increases slightly (0.02 A); (3) the low temperature resistivity behavior changes from superconducting with T_c onset of 6 K for Sr>1.5 afu to semiconducting for Sr≤1.5 afu; (4) the positions of the superlattice peaks around the (001) reflections become more incommensurate with respect to the parent structure.

845 **Glow-discharge synthesis of silicon nitride precursor powders.** Ho, P. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800 (US)); Buss, R.J.; Loehman, R.E. *Journal of Materials Research (USA),* 4(4): 873-881 (Jul 1989). DOE Contract AC04-76DP00789.

A radio-frequency glow discharge is used for the synthesis of submicron, amorphous, silicon nitride precursor powders from silane and ammonia. Powders are produced with a range of Si/N ratios, including stoichiometric, Si-rich, and N-rich, and contain substantial amounts of hydrogen. The powders appear to be similar to silicon diimide and are easily converted to oxide by water vapor. The powders lose weight and crystallize to a mixture of α and β-Si_3N_4 after prolonged heating at 1600°C. Studies of spectrally and spatially resolved optical emission from the plasma are reported.

846 **Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$.** Lee, W.C. (Ames Laboratory-United States Department of Energy

and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)); Klemm, R.A.; Johnston, D.C. *Physical Review Letters (USA)*, 63(9): 1012-1015 (28 Aug 1989). DOE Contract W-7405-ENG-82.

Magnetic susceptibility data are presented for the title compounds. All show negative curvature below $\sim 2T_c$. Data for grain-aligned $YBa_2Cu_3O_7$ are in excellent agreement with a new calculation of the superconducting fluctuation diamagnetism. We infer *s*-wave pairing and Ginzburg-Landau coherence lengths $\xi_{ab}(0)=13.6\pm0.8$ A and $\xi_c(0)=1.23\pm0.19$ A. Both of the order-parameter bands are found to be essential in the fit. Part of the above negative curvature is inferred to arise from the normal-state background.

847 **Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors.** Lindberg, P.A.P. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (US)); Shen, Z.; Wells, B.O.; Dessau, D.S.; Borg, A.; Lindau, I.; Spicer, W.E.; Mitzi, D.B.; Kapitulnik, A. *Applied Physics Letters (USA)*, 55(11): 1141-1143 (11 Sep 1989).

Polarization-dependent angle-resolved photoemission experiments in the constant final state mode (absorption measurements) were performed on single crystals of the Bi-based 2212 material using synchrotron radiation in the photon energy range 10–40 eV. Evidence of polarization-dependent transitions due to Bi $5d \rightarrow 6p$, Sr $4p \rightarrow 4d$, and Ca $3p \rightarrow 3d$ excitations is observed. The data show that the electronic charge is highly localized to the layers of the crystal structure, thus providing a direct spectroscopic confirmation of the two-dimensional nature of these types of materials. Polarization-sensitive absorption signals at 14–15 eV attributed to Bi $6s \rightarrow 6p$ transitions show that the density of states (DOS) of the Bi $6p_z$ holes peaks at about 0.7 eV higher energy than the DOS of the Bi $6p_{x,y}$ holes.

848 **Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors.** Singh, J.P. (Materials and Components Technology Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Leu, H.J.; Poeppel, R.B.; Van Voorhees, E.; Goudey, G.T.; Winsley, K.; Shi, D. *Journal of Applied Physics (USA)*, 66(7): 3154-3159 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

The effects of Ag and Ag_2 O additions on the mechanical and superconducting properties of YBa_2 Cu_3 $O_{7-\delta}$ superconductors were studied. The addition of 20-vol % Ag resulted in an increase in strength from ≈40 to 75 MPa and a twofold increase in the critical current density (J_c) of YBa_2 Cu_3 $O_{7-\delta}$ bar specimens. These improvements are believed to be due to the increased density. Furthermore, Ag particles may relax the residual stresses resulting from the expansion anisotropy of individual grains, and may provide increased resistance to crack propagation by pinning the propagating cracks; these effects would also increase the strength. The addition of 30-vol % Ag resulted in an increase in strength to 87 MPa, but it was associated with a decrease in J_c . This decrease in J_c at high Ag content is believed to be due to the presence of oxygen deficient nonsuperconducting tetragonal phase as well as continuous Ag phase. Similar effects were also observed after Ag_2 O additions.

849 **Application of neutron diffraction to the characterization of residual thermal strains in $YBa_2Cu_3O_{7-\delta}$/Ag.** Kupperman, D.S. (Materials and Components Technology Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Singh, J.P.; Faber, J. Jr.; Hitterman, R.L. *Journal of Applied Physics (USA)*, 66(7): 3396-3398 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

Additions of silver (Ag) have been reported to improve the mechanical properties of high-temperature superconductor by $YBa_2Cu_3O_{7-\delta}$ (abbreviated YBCO). However, during fabrication of YBCO/Ag composites, differential thermal expansion upon cooling can lead to potentially troublesome residual stresses. The Intense Pulsed Neutron Source and General Purpose Powder Diffractometer at Argonne National Laboratory were used to show that neutron diffraction techniques can be applied to YBCO/Ag composites to measure bulk residual strains in the constituent parts, and to determine the effect of Ag on stoichiometry (and thus on the critical current density). We have observed residual tensile strains in Ag as a function of crystallographic direction; three strains range from as high as 0.085% in 15% Ag samples to as low as about 0.02% in a 30% Ag sample. Compressive strains in the YBCO (111) crystallographic direction were approximated by correcting for the diffraction peak shift due to changes in stoichiometry with varying Ag content. The estimated compressive-strain values vary from 0.04% (15% Ag) to 0.09% (20% Ag) to 0.01% (30% Ag), with an uncertainty of about 0.03%. The presence of significant average tensile strain in the Ag, particularly for 15% and 20% Ag samples, indicates good interface bonding between YBCO and Ag.

850 **Infrared reflectivity spectra of single crystals of La_2CuO_4.** Bazhenov, A.V. (Institute of Solid State Physics, U.S.S.R. Academy of Sciences, Chernogolovka, Moscow District, 142432, Union of Soviet Socialist Republics (SU)); Fursova, T.N.; Timofeev, V.B.; Cooper, A.S.; Remeika, J.P.; Fisk, Z. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4413-4418 (1 Sep 1989).

Infrared reflectivity spectra of a La_2CuO_{4+x} single crystal have been studied over a spectral range of 50–5500 cm^{-1}. Anisotropy of the spectra has been observed, indicating a strong anisotropy of the high-frequency conductivity of the crystal. New lines have been found in the optical-phonon excitation spectra. A classification of lattice optical vibrations has been proposed. Spectral reconstruction has been observed in the phonon region of 370 and 445 cm^{-1} at $T_0=220\pm5$ K, which correlates with the antiferromagnetic transition.

851 **Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$.** Kebede, A. (Center for Materials Research, Temple University, Philadelphia, Pennsylvania 19122 (US)); Jee, C.S.; Schwegler, J.; Crow, J.E.; Mihalisin, T.; Myer, G.H.; Salomon, R.E.; Schlottmann, P.; Kuric, M.V.; Bloom, S.H.; and others. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4453-4462 (1 Sep 1989).

An extensive study of magnetic, thermal, transport, and structural properties of the alloy $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$ is presented. The endpoints of the alloy series are a high-temperature superconductor Y-Ba-Cu-O and an antiferromagnetic semiconductor (Pr-Ba-Cu-O, T_N=17 K). The superconducting transition temperature is reduced with increasing Pr concentration following the Abrikosov-Gorkov pair-breaking curve with critical concentration $x_{cr}=0.62$. Alloying also reduces the Neel temperature approximately linearly with the Y content, and there is a concentration region $(0.4<x<0.6)$ where antiferromagnetism and superconductivity is suggested to coexist. The specific heat, the susceptibility, the magnetic ordering, and the metal-to-semiconductor transition seen in the resistivity are consistent with the picture that Y^{3+} is replaced by Pr^{4+} with some degree of valence admixture of the Pr^{3+} configuration.

852 **Neutron scattering study of magnetic excitations in $YBa_2Cu_3O_{6+x}$.** Tranquada, J.M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973 (US)); Shirane, G.; Keimer, B.; Shamoto, S.; Sato, M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4503-4516 (1 Sep 1989). DOE Contract AC02-76CH00016.

Inelastic neutron scattering has been used to study magnetic excitations in several single crystals of $YBa_2Cu_3O_{6+x}$. In particular, an extensive study of spin waves in a large crystal with x=0.3 has been performed. As in La_2CuO_4, a very large superexchange is found within the CuO_2 layers, with $J_{\parallel}=80_{-30}^{+60}$ meV. The optical-mode spin-wave energies are higher than 30 meV, indicating that $J_{\perp 1}$, the coupling between nearest-neighbor CuO_2 planes, is $\gtrsim 2$ meV. From the dispersion and splitting of the acoustic modes, we obtain values of 0.020 ± 0.005 meV for the effective exchange between next-nearest-neighbor layers, $J_{\perp 2}$, and 0.035 ± 0.005 meV for the anisotropy parameter D. The weak anisotropy gives the planes an *XY*-like symmetry; no evidence has been found for any in-plane anisotropy. The CuO_2 bilayers remain strongly correlated well above T_N, and dispersion of the acoustic modes appears 30 K above T_N. The decrease of the magnetic order parameter below 30 K in the x=0.3 crystal is interpreted as the onset of an incoherent ordering of Cu moments in the oxygen-deficient CuO_x layers. Low-energy inelastic scattering associated with the transition is also observed. Searches for low-energy magnetic fluctuations in several superconducting single crystals have so far been unsuccessful.

853 **Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds.** Peng, J.L.

(Department of Physics, University of California, Davis, Davis, California 95616 (US)); Klavins, P.; Shelton, R.N.; Radousky, H.B.; Hahn, P.A.; Bernardez, L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4517-4526 (1 Sep 1989). DOE Contract W-7405-ENG-48.

Substitution of Pr for Y in the $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ system depresses T_c, with superconductivity disappearing for $x \geq 0.5$. The origin of this T_c depression is still controversial, as is the valence state of the Pr ion. In order to study these problems, single-phase materials were prepared with x=0.0, 0.1, 0.2, 0.3, 0.35, 0.4 0.45, 0.5, 0.6, 0.7, 0.9, and 1.0. Under certain annealing conditions, these types of samples will phase separate into $YBa_2Cu_3O_{7-\delta}$ and $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, showing two transitions in the magnetization, but will still appear single phase from x-ray diffraction. We have overcome this problem through specific annealing conditions of time, temperature, and atmosphere. We find that the superconductivity is strongly suppressed as a function of Pr concentration, with a behavior which is consistent with the classical Abrikosov-Gor'kov pair-breaking theory. The critical fields versus T show a "bell"-shaped behavior, which is consistent with the presence of magnetic pair-breaking interactions. The measured temperature dependence of the critical field, H_{c2} near T_c, and the Pauli susceptibility, are used to estimate the physical parameters λ_{GL}, ξ_{GL}, and γ.

854 Photoemission and inverse-photoemission studies of $Ba_{1-x}K_xBiO_{3-y}$. Wagener, T.J. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455 (US)); Meyer, H.M. III; Hill, D.M.; Hu, Y.; Jost, M.B.; Weaver, J.H.; Hinks, D.G.; Dabrowski, B.; Richards, D.R. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4532-4537 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

X-ray and inverse photoemission were used to investigate the occupied and unoccupied electronic states of $Ba_{1-x}K_xBiO_{3-y}$. The results show metallic character with a low density of states on either side of E_F and a broad manifold from −13 to 2 eV consisting of Bi-O *sp* hybrids. Generally good agreement of theory with experiment is found except that the centroid of the calculated Bi-O manifold is ~1 eV too close to E_F (as for the high-T_c superconductors). Core-level results indicate single chemical environments for O, Ba, and K. The Bi 4*f* results suggest inequivalent Bi environments. All core-level spectra show energy-loss features shifted ~1 eV to a higher binding energy relative to the main line. Unoccupied electronic state structures at 4, ~7, ~9, and 14 eV reflect Bi 6*p*, Ba 5*d*, K 3*d*, and Ba 4*f* bands, respectively. Photon emission associated with plasmon decay is observed as a constant energy feature at $h\nu$=22.4 eV. Inverse-photoemission resonance studies for incident electron energies that would excite O 2*s*-2*p* transitions show no enhancement of the O 2*p* holes directly above E_F.

855 Spin dynamics in the two-dimensional quantum antiferromagnet La_2CuO_4. Yamada, K. (Department of Physics, Tohoku University, Aramaki, Aoba, Sendai 980, Japan (JP)); Kakurai, K.; Endoh, Y.; Thurston, T.R.; Kastner, M.A.; Birgeneau, R.J.; Shirane, G.; Hidaka, Y.; Murakami, T. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4557-4565 (1 Sep 1989).

Using large single crystals (~2 cm^3), we have extended previous elastic and inelastic neutron scattering studies of the spin dynamics in the two-dimensional (2D) quantum antiferromagnet La_2CuO_4. We observe well-defined magnetic peaks for constant energy scans across the 2D magnetic rod for a wide range of temperatures and energies. The spectra are compared quantitatively with theoretical models. Simple spin-wave theory satisfactorily describes the experimental results well below T_N. The thermal excitations of the low-energy ($\hbar\omega \leq 3$ meV) spectra, however, appear to deviate from the theory as T_N is approached. The overall temperature and energy dependence of the spectra above T_N (245–520 K) can be explained by the formula of Chakravarty, Halperin, Nelson, and Tyc for the dynamical structure factor $S(\mathbf{q},\omega)$ with no adjustable parameters. We do, however, observe a 2D elastic component which grows rapidly as T_N is approached; it is hypothesized that this arises primarily from magnetic defects and is analogous to the "central peak" observed for many structural phase transitions.

856 Neutron scattering study of the magnetic excitations in metallic and superconducting $La_{2-x}Sr_xCuO_{4-y}$. Thurston, T.R. (Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Birgeneau, R.J.; Kastner, M.A.; Preyer, N.W.; Shirane, G.; Fujii, Y.; Yamada, K.; Endoh, Y.; Kakurai, K.; Matsuda, M.; and others. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4585-4595 (1 Sep 1989). DOE Contract AC02-76CH00016.

We report on neutron scattering studies of the dynamic spin correlations in $La_{2-x}Sr_xCuO_{4-y}$. Two superconducting and one nonsuperconducting single crystals were studied. All three of the samples exhibited metallic normal-state resistivity modified by corrections consistent with localization effects. The structure factor $S(\mathbf{Q},\omega)$ measured in these samples reflects to a first approximation short-range two-dimensional antiferromagnetic spin correlations closely related to those found in insulating La_2CuO_4. In addition, $S(\mathbf{Q},\omega)$ measured in the superconducting samples has an incommensurate, double-peaked structure which is not present in the nonsuperconducting crystal. The integrated ($\int dQ$) intensities of the scattering at both concentrations are nearly independent of temperature over the range $k_BT \gg \hbar\omega$ to $k_BT \ll \hbar\omega$ for energy transfers greater than ~6 meV. Furthermore, the difference in the temperature dependence of the intensity between the nonsuperconducting and superconducting samples for energy transfers less than ~6 meV suggests that a gap may be forming in the magnetic excitation spectrum of the superconducting samples. The relationship of these results to the superconductivity in $La_{2-x}Sr_xCuO_{4-y}$ is discussed.

857 Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy. Lindberg, P.A.P. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (US)); Shen, Z.; Dessau, D.S.; Wells, B.O.; Mitzi, D.B.; Lindau, I.; Spicer, W.E.; Kapitulnik, A. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 5169-5171 (1 Sep 1989).

Angle-resolved photoemission studies of single-crystalline La-doped Bi-Sr-Ca-Cu- 90-K superconductors ($Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$) were performed utilizing synchrotron radiation covering the photon energy range 10–40 eV. The data conclusively reveal a dispersionless character of the valence-band states as a function of the wave-vector component parallel to the *c* axis, in agreement with the predictions of band calculations. Band effects are evident from both intensity modulations of the spectral features in the valence band and from energy dispersions as a function of the wave vector component lying in the basal *a*-*b* plane.

858 Antiferromagnetic resonance in La_2CuO_{4+y}. Kaplan, S.G. (Laboratory of Atomic and Solid State Physics and Materials Science Center, Cornell University, Ithaca, New York 14853 (US)); Noh, T.W.; Sievers, A.J.; Cheong, S.; Fisk, Z. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 5190-5193 (1 Sep 1989).

Our attempts to observe the antiferromagnetic resonance (AFMR) modes in La_2CuO_{4+y} in both single crystal and small particle forms have been unsuccessful. An argument based on a magnetic-susceptibility sum rule shows that the resonance previously identified with the AFMR in polycrystalline La_2CuO_{4+y} [R. T. Collins, *et al.*, Phys. Rev. B 37, 5817 (1988)] is too strong to be compatible with a magnetic spin-wave mode. No evidence of an AFMR mode is found in our single-crystal La_2CuO_{4+y} transmission measurements versus magnetic field. Additional measurements on small particles show that the broad resonant feature observed around 8 cm^{-1} is produced by an electric-dipole-active superconducting sphere resonance of the La_2CuO_{4+y} particles.

859 Temperature, frequency, and rf field dependence of the surface resistance of polycrystalline $YBa_2Cu_3O_{7-x}$. Delayen, J.R. (Argonne National Laboratory, Engineering Physics Division, 9700 South Cass Avenue, Argonne, Illinois 60439 (US)); Bohn, C.L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 5151-5154 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

The rf surface resistance of a single bulk polycrystalline $YBa_2Cu_3O_{7-x}$ sample was measured with TEM resonant cavities as a function of temperature from 4.2 to 100 K, rf field amplitude from 0 to 640 G, and frequency from 175 to 1050 MHz. The surface resistance increased monotonically with rf field amplitude, saturating at a value approximately 5% of the normal-state surface resistance. The surface resistance is strongly frequency and temperature dependent below the saturation region and weakly frequency and

temperature dependent above. Low-field surface resistances as small as $\lesssim$1.1 $\mu\Omega$ (at 175 MHz) were observed at T=4.2 K. The superconducting state did not break down, even at the highest field achieved (~640 G).

860 **Pressure dependence of the Cu magnetic order in $RBa_2Cu_3O_{6+x}$.** Lynn, J.W. (Center for Superconductivity Research, Department of Physics, University of Maryland, College Park, Maryland 20742 (US)); Li, W.; Trevino, S.F.; Fisk, Z. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5172-5175 (1 Sep 1989).

Neutron-diffraction measurements have been carried out as a function of hydrostatic pressure to study the magnetic order of the Cu spins in $NdBa_2Cu_3O_{6.35}$ and $NdBa_2Cu_3O_{6.1}$. In the high-temperature phase, where the Cu planes order antiferromagnetically, we find that the Neel temperature T_{N1} is *very strongly* dependent on pressure, increasing at the rate of ~23 K/kbar. We attribute this phenomenal sensitivity to the two-dimensional-like behavior of this magnetic system. In the low-temperature phase, which is associated with magnetic ordering of the chains, only a small change in the ordering temperature T_{N2} is observed.

861 **Bulk superconductivity above 30 K in T^*-phase compounds.** Hundley, M.F. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Thompson, J.D.; Cheong, S.; Fisk, Z.; Schwarz, R.B.; Schirber, J.E. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5251-5254 (1 Sep 1989). DOE Contract AC04-76DP00789.

High-pressure (3 kbar) oxygenation of (La, Sm, Sr)$_2$CuO$_4$ compounds having the T^* structure leads to bulk superconducting transitions above 30 K and the appearance of a diamagnetic response at temperatures as high as ~37 K. With increasing oxygenation pressure, the electrical resistivity and thermoelectric power progress from hoppinglike to more nearly metalliclike transport. The similarity in T_c and transport character with those of T-phase $La_{2-x}Sr_xCuO_4$, despite significant structural differences, further constrains possible mechanisms for superconductivity in the cuprates.

862 **Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system.** Shi, D. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Boley, M.S.; Welp, U.; Chen, J.G.; Liao, Y. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5255-5258 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

A fundamental pinning mechanism has been identified in the Bi-Sr-Ca-Cu-O system. The pinning strength has been greatly increased by the introduction of calcium- and copper-rich precipitates into the sample matrix. The calcium and copper were supersaturated in the system by complete melting, and the fine calcium and copper particles precipitated during subsequent crystallization anneal to obtain the superconducting phases. The intragrain critical current density has been increased from the order of 10^5 A/cm^2 to 10^7 A/cm^2 at 5 T. The corresponding pinning mechanisms are discussed.

863 **Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$.** Wells, B.O. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (US)); Lindberg, P.A.P.; Shen, Z.; Dessau, D.S.; Spicer, W.E.; Lindau, I.; Mitzi, D.B.; Kapitulnik, A. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5259-5262 (1 Sep 1989).

We have used photoemission spectroscopy to examine the symmetry of the occupied states of the valence band for the La-doped superconductor $Bi_2(Ca,Sr,La)_3Cu_2O_8$. While the oxygen states near the bottom of the 7-eV wide valence band exhibit predominantly O $2p_z$ symmetry, the states at the top of the valence band extending to the Fermi level are found to have primarily O $2p_x$ and O $2p_y$ character. We have also examined anomalous intensity enhancements in the valence-band features for photon energies near 18 eV. These enhancements, which occur at photon energies ranging from 15.8 to 18.0 eV for the different valence-band features, are not consistent with either simple final-state effects or direct O 2s transitions to unoccupied O 2p states.

864 **Angular dependence of the upper critical field of $YBa_2Cu_3O_{7-\delta}$ single crystals.** Welp, U. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Kwok, W.K.; Crabtree, G.W.; Vandervoort, K.G.; Liu, J.Z. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5263-5265 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

The angular dependence of the upper critical field of a $YBa_2Cu_3O_{7-\delta}$ single crystal has been measured with dc magnetization. The results are describable with a three-dimensional anisotropic Ginzburg-Landau theory with an anisotropy of five in the upper critical field.

865 **Magnetic ordering in $La_2Cu_{1-x}Zn_xO_{4-y}$.** Chakraborty, A. (Department of Physics, The Ohio State University, Columbus, Ohio 43210-1106 (US)); Epstein, A.J.; Jarrell, M.; McCarron, E.M. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5296-5299 (1 Sep 1989).

We report the magnetization $M(H,T)$ of $La_2Cu_{1-x}Zn_xO_{4-y}$ for x varying from 0.00 to 0.03. A suppression of the Neel temperature as a function of doping is observed. In contrast, neutron-diffraction experiments show that the low-temperature macroscopic ordered magnetic moment on the copper sites does not change as a function of doping. For applied fields larger than $H_c(T)$, the susceptibility as a function of temperature for the doped samples does not show an obvious signature of ordering at T_N. This is consistent with the material having a macroscopic ferromagnetic moment below T_N for $H>H_c(T)$.

866 **Boron carbide structure by Raman spectroscopy.** Tallant, D.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Aselage, T.L.; Campbell, A.N.; Emin, D. *Physical Review [Section] B: Condensed Matter (USA),* 40(8): 5649-5656 (15 Sep 1989). DOE Contract AC04-76DP00789.

We have obtained and analyzed Raman spectra of single-crystal, hot-pressed, and chemical-vapor-deposited boron carbide materials over their single-phase region (from ~9 to ~20 at. % carbon). These spectra provide insight into the substitutional disorder that characterizes these structurally ordered solids. In particular, although icosahedra and chain structures occupy regular lattice positions, there is local substitutional disorder resulting from the occupancy of certain sites within the icosahedra and chains by either boron or carbon atoms. Comparison of boron carbide Raman spectra with the Raman spectra of α-rhombohedral boron, boron phosphide, and boron arsenide has confirmed the following structural model derived from theoretical considerations and electrical and thermal transport data. The boron carbide composition with nearly 20 at. % carbon is composed of $B_{11}C$ icosahedra linked by carbon-boron-carbon chains. As the carbon content is reduced toward approximately 13 at. %, carbon-boron-carbon chains are progressively replaced by carbon-boron-boron chains. Further reduction in the carbon content results in the replacement of $B_{11}C$ icosahedra with B_{12} icosahedra.

867 **Hydrogen interactions in PdH_n ($1 \leq n \leq 4$).** Wang, X.W. (Department of Physics, University of California, Berkeley, California 94720 (US)); Louie, S.G.; Cohen, M.L. *Physical Review [Section] B: Condensed Matter (USA),* 40(8): 5822-5825 (15 Sep 1989). DOE Contract AC03-76SF00098.

By use of a first-principles pseudopotential total-energy approach, the electronic and structural properties of PdH_n are studied with n varying from 1 to 4. The interaction between a pair of hydrogen atoms in the octahedral cage of the Pd fcc lattice is examined in the light of recent claims of cold-fusion processes in metal hydrides. The calculation shows that there is virtually no heavy d-electron screening effect for the hydrogen interactions at short distances. The separation between hydrogen atoms remains much larger than the value required for a significant fusion rate. However, our total-energy results indicate that, with a moderate chemical potential shift, a very high density of hydrogen ($n \geq 2$) can be achieved inside the Pd crystal.

3606 Other Materials

Refer also to citation(s) 139, 197, 246, 249, 257, 258, 259, 263, 303, 550, 700, 718, 726, 756, 766, 782, 784, 796, 797, 979, 995, 1058, 1071, 1077, 1078, 1211, 1213, 1848, 1851

868 (AGARD-CP-449, pp. 13) **Composite material systems for high temperature applications.** Thompson, E.R. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar

1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

One approach to the demands of high temperature, structural applications, being actively pursued, is through the development of composite materials. For applications up to approximately 1200 C, the materials research is primarily centered upon the fiber reinforcement of glass and glass-ceramic matrices. For applications above 1200 C, the development of coating systems for the protection of high-strength carbon-carbon composites is the prime focus. In terms of fabrication, the glass and glass-ceramic matrix composites reinforced by carbon and silicon carbide fiber yearns can be understood by considering the thermoplastic nature of the matrix constituent. Continuous, as well as chopped, fibers were successfully used to reinforce these brittle matrices. When optimally fabricated, the resultant composites have displayed a combination of high apparent toughness and high strength at room and elevated temperature. Carbon-carbon composites have extremely high temperature (greater than 2000 C) capability and excellent strength retention in inert environments. The major application limiting property of these composites is the lack of coatings which will provide the required long life, high-temperature oxidation resistance. Multilayer coating approaches which depend upon silicon nitride as the primary oxidation resistant barrier were developed. The background leading to this choice and a consideration of the experience with this coating are considered.

869 (ATR–88(8359)-5) **Raman and RBS studies of ion implanted semiconductors.** Bowman, R.C. Jr.; Jamieson, D.N. Aerospace Corp., El Segundo, CA (USA). May 1988. 14p. Available from NTIS, PC A03/MF A01.

Raman spectroscopy and Rutherford backscattering spectrometry (RBS) were used to assess boron and silicon implants on the properties of single crystal silicon, GaAs, and CdTe. The behavior of these different semiconductors under identical implant conditions was compared. Changes in the Raman optic phonon spectra reflect the extent of lattice damage caused by the ion implants as well as the ability of various annealing procedures to remove this damage. The Raman results are generally confirmed by RBS ion-channeling measurements. Furthermore, these techniques are shown to provide complementary information on the distribution and nature of implant damages.

870 (CONF-890953–8) **$CeRu_2Si_2$ and URu_2Si_2: Same or different?.** Koelling, D.D. Argonne National Lab., IL (USA). Jul 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on the physics of highly correlated electron systems; Santa Fe, NM (USA); 11-15 Sep 1989. Order Number DE90001981. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimentally, both $CeRu_2Si_2$ and URu_2Si_2 exhibit magnetic behavior suggestive of localized f-orbital behavior with strong correlations. Such consistency between comparable cerium and uranium compounds is normally observed behavior. However, the consistency is less clear when the band structures of the two materials are compared: the Ce compound looks very much like a strongly hybridized f electron system and the U compound like a weakly hybridizing f electron material. What can one learn from this apparent inconsistency? Further, a stronger hybridizing system is less well dominated by the intra-atomic Coulomb term making the sensitivity to exchange correlation functional used greater. This however proves not to be a serious complication in $CeRu_2Si_2$. 18 refs.

871 (CONF-891091–2) **Fiber-optic sensors for composite cure analysis and lifetime nondestructive evaluation.** Muhs, J.D.; Cates, M.R.; Tobin, K.W.; Capps, G.J.; Beshears, D.L. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 8. international congress on applications of lasers and electro-optics (ICALEO 8); Orlando, FL (USA); 15-20 Oct 1989. Order Number DE90001739. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A proposed multiplexed fiber-optic sensor system capable of analyzing a composite material during its curing cycle and over its service lifetime is presented. The sensor is composed of two independent sensing schemes that will ultimately be multicomplexed onto a specialized single-mode/multimode optical fiber. The first sensing scheme is a fiber-optic viscosity and temperature sensor used for composite cure analyses. This sensor is based on (1) the laser-induced viscosity-dependent fluorescence phenomena observed in epoxy-based composite materials and (2) the temperature-dependent decay-time fluorescence phenomena observed in thermographic phosphors. The second sensor is based on a low-finesse, single-mode fiber-optic Fabry-Perot interferometer and is used as a strain/vibration sensor for lifetime nondestructive evaluations on composites. Experimental results have determined that these sensor concepts are feasible alternatives to cure-analysis monitors and conventional strain-analysis techniques. 15 refs., 7 figs.

872 (CONF-891119–3) **Parametric effects of glass reaction under unsaturated conditions.** Bates, J.K.; Gerding, T.J.; Woodland, A.B. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90002275. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Eventual liquid water contact of high-level waste glass stored under the unsaturated conditions anticipated at the Yucca Mountain site will be by slow intrusion of water into a breached container/canister assembly. The water flow patterns under these unsaturated conditions will vary, and the Unsaturated Test method has been developed by the YMP to study glass reaction. The results from seven different sets of tests done to investigate the effect of systematically varying parameters, such as glass composition, composition and degree of sensitization of 304L stainless steel, water input volume, and the interval of water contact are discussed. Glass reaction has been monitored over a period of five years, and the parametric effects can result in up to a ten-fold variance in the degree of glass reaction.

873 (CONF-891120–3) **Laser-induced flourescence studies of Cm^{3}+ complexes in solution.** Beitz, J.V. Argonne National Lab., IL (USA). [1989]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere; Monterey, CA (USA); 6-10 Nov 1989. Order Number DE90001758. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Photophysical studies of complexed Cm^{3}+ in solution have been carried out using a laser-induced fluorescence method. The luminescence decay rate of the first excited J=7/2 state of Cm^{3}+ was measured using carbonate, nitrate, and two extractant aminocarboxylic acids as complexing ligands in aqueous solution. $Cm(ClO_4)_3$ dissolved in methyl sulfoxide also was studied. Solvent deuteration provided insight into the dominant nonradiative luminescence quenching mechanism which was found to be electronic-to- vibrational energy transfer. Emission spectra of Cm^{3}+ complexed by the various ligands studied are reported. Prior spectroscopic and photophysical studies of Cm^{3}+ in solution are reviewed. 24 refs. , 2 figs., 1 tab.

874 (CONF-8911100–1) **Isotope driven critical scattering and phase separation in mixtures of deuterated and protonated polymers.** Wignall, G.D.; Bates, F.S. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. DMR-8311769. From Taniguchi conference on polymer research by neutron scattering; Kyoto (Japan); 7-9 Nov 1989. Order Number DE90000574. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Four separate isotopic polymer mixtures have been examined by SANS: deuterated and protonated atactic polystyrenes, 1,4-polybutadienes, polyvinylethylenes (also referred to as 1,2-polybutadienes), and polyethylethylenes (also known as 1,2-polybutenes). With the exception of the polystyrenes, all polymers were characterized for number average degree of polymerization N_N and polydispersity N_W/N_N by membrane osmometry and high pressure size exclusion chromatography (HPSEC), respectively.

SANS data were collected on the 30-m instrument at the National Center for Small- Angle Scattering Research located at Oak Ridge National Laboratory. 29 refs., 4 figs., 1 tab.

875 (LA-UR–89-3001) **Rotational magnetic processes in $YB_2Cu_3O_7$.** Liu, Liwen; Kouvel, J.S.; Brun, T.O. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by National Science Foundation. DOE Contract W-7405-ENG-36. DMR-84-06898;DMR-87-22880. (CONF-891117–2: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90000541. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A polycrystalline superconducting thin-disk sample was rotated in a fixed field ($\vec{H}$) at 4.2 K, and the vector magnitude and orientation of the total magnetization ($\vec{M}$) were measured as the sample-rotation angle (Θ) was slowly cycled between 0 and 360°. The measured $\vec{M}$ was decomposed into a penetrating (vortex) flux component $\vec{M}_p$ that rotates rigidly with the sample at very small Θ and a diamagnetic (shielding) component $\vec{M}_d$ that stays antiparallel to $\vec{H}$. As Θ is raised, $\vec{M}_p$ deviates from rigid rotation, and the deviations are very different for the zero-field-cooled (ZFC) and field-cooled (FC) states at the same H, indicating different distributions in the strengths of the initial pinning forces. However, M_d is exactly the same for both states and closely equals $X_o H$, where X_o is the low-H (ZFC) diamagnetic susceptibility. At still higher Θ, $\vec{M}_p$ rotates up to some critical angle relative to $\vec{H}$, where it remains as the sample continues to turn. This frictional behavior presumably derives from the dissipative motion of the vortices between pinning centers. 6 refs., 3 figs.

876 (LA-UR–89-3002) **Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$.** Said, M.R.; Kouvel, J.S.; Brun, T.O. Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by National Science Foundation. DOE Contract W-7405-ENG-36. DMR-84-06898;DMR-87-22880. (CONF-891117–1: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90000540. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This cubic pseudobinary compound with antiferromagnetic order and spin-glass properties below T_g (36 K) was studied by magnetization-vector measurements on a field-cooled (fc) polycrystalline sample disk rotated in various fixed fields ($\vec{H}$). At 4.2 K, the fc-induced anisotropy field $\vec{H}_K$ is seen to turn rigidly with the sample for all rotational magnetization follows $\vec{H}_K$ very closely, it is deduced that $H_K > 100$ kOe. At 20 K, $\vec{H}_K$ turns rigidly but only below a threshold field, above which $\vec{H}_K$ rotates up to some critical angle relative to $\vec{H}$, where it remains as the sample continues to turn. Thus, $\vec{H}_K$ rotates frictionally relative to the sample. Nevertheless, it is found that its magnitude continues to exceed 100 kOe. 7 refs., 3 figs.

877 (LA-UR–89-3301) **Development of inherently safe and environmentally acceptable intelligent processing technologies for HTS materials.** Peterson, E.J.; Wangen, L.E.; Ott, K.C.; Muenchausen, R.E.; Parkinson, W.J. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891067–1: Superconductivity: the manufacturing challenges conference and tabletop exhibits, Oak Brook, IL (USA), 16-18 Oct 1989). Order Number DE90000678. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of new processing technologies for the production, fabrication, and application of advanced materials proceeds through several complementary dimensions. The advanced materials dimension includes basic research on materials synthesis, composition, and properties; materials processing research; engineering characterization and materials applications; and product and process engineering. The health and environmental dimension includes identification of potential health and environmental constraints; characterization of candidate processes for waste and effluent quality; process optimization for both economic and environmental benefit; and development of control strategies to deal with health and environmental problems that cannot be solved through process modification. The intelligent processing dimension includes application of available sensors and the development of new diagnostics for real-time process measurements; development of control strategies and expert systems to use these process measurements for real-time process control; and development of capabilities to optimize working processes in real-time for both product quality and environmental acceptability. This paper discusses these issues in the context of the Laboratory's efforts to develop technologies based on the processing of the new high-temperature superconducting ceramic oxides.

878 (LBL–27661) **Thermally stable metal/GaAs contacts.** Ding, Jian. Lawrence Berkeley Lab., CA (USA). Jun 1989. 132p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90002122. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Further improvement of electrical properties and thermal stability of reactively sputtered refractory metal nitride contacts on GaAs and In-based ohmic contacts to GaAs require a systematic study of the relationships between structural and electrical characteristics at the interface. In this study, the interface morphologies and structures of Nb/GaAs, NbN/GaAs, TiN/GaAs, WN/GaAs and In/GaAs contacts have been investigated before and after annealing at temperatures up to 950°C by transmission electron microscopy and diffraction, energy dispersive spectrometry of x-rays, x-ray diffractometry and cross-sectional high resolution transmission electron microscopy. The results from these techniques were combined to provide detailed descriptions of the structural evolution of the interface region in refractory metal nitride/GaAs and In/GaAs heterojunctions. Structural details were related to the corresponding electrical characteristics. 145 refs., 44 figs.

879 (N–89-17530) **Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report.** Wu, M.K.; Higgins, C.A.; Leong, P.T.; Chou, H.; Loo, B.H.; Curreri, P.A.; Peters, P.N.; Sisk, R.C.; Huang, C.Y.; Shapira, Y. National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center. Jan 1989. 16p. (NASA-TM–100350;NAS–1.15:100350). Available from NTIS, PC A03/MF A01.

Magnetic suspension effect was first observed in samples of $YBa_2Cu_3O_7$/AgO(Y-123/AgO) composites. Magnetization measurements of these samples show a much larger hysteresis which corresponds to a large critical current density. In addition to the Y-123AgO composites, recently similar suspension effects in other RE-123/AgO, where RE stands for rare-Earth elements, were also observed. Some samples exhibit even stronger flux pinning than that of the Y-123/AgO sample. An interesting observation was that in order to form the composite which exhibits strong flux trapping effect the sintering temperature depends on the particular RE-123 compound used. The paper presents the detailed processing conditions for the formation of these RE-123/AgO composites, as well as the magnetization and critical field data.

880 (N–89-20820) **Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989.** Wahi, A. K.; Lindau, I.; Spicer, W. E. Stanford Univ., CA (USA). Mar 1989. 19p. (NASA-CR–184840;NAS–1.26:184840). Available from NTIS, PC A03/MF A01.

Interfacial morphology and Fermi level pinning behavior at the interfaces of Al, Ag, and Pt with UHV-cleaved CdTe and ZnTe have been studied using X-ray and ultraviolet photoemission spectroscopies. Results are compared to metal/HgCdTe interface formation, where the weak HgTe bond and consequent ease of Hg loss strongly influence semiconductor disruption and metal-semiconductor intermising. For Al/CdTe, the strong Al-Te reaction yields a significantly more extensive Al-Te reacted region than has been observed for HgCdTe. The Al/ZnTe interface is observed to be more abrupt than Al/CdTe. The final Fermi level pinning positions, Ef-Evbm for Al, Ag, and Pt on p-type CdTe and p-ZnTe have been determined. Efi is found to be roughly the same for both CdTe and

ZnTe, with the value for ZnTe lying approximately 0.2 eV closer to the VBM for all three metals. From these results, one would expect Schottky barriers of about the same height for these metals on p-CdTe and p-ZnTe; and also that, in principle, metal interfaces with the two alloys HgCdTe and HgZnTe would have the same properties. Comparisons and implications for electrical behavior of metal contacts to the alloys are discussed.

881 (N–89-21036) **Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report.** Misra, A.K. Sverdrup Technology, Inc., Cleveland, OH (USA). Mar 1989. 46p. (NASA-CR–182260;E–4648;NAS–1.26:182260). Available from NTIS, PC A03/MF A01.

Chemical compatibility of several reinforcement materials with three niobium aluminides, Nb3Al, Nb2Al, and NbAl3, were examined from thermodynamic considerations. The reinforcement materials considered in this study include carbides, borides, nitrides, oxides, silicides, and Engel-Brewer compounds. Thermodynamics of the Nb-Al system were reviewed and activities of Nb and Al were derived at desired calculation temperatures. Criteria for chemical compatibility between the reinforcement material and Nb-Al compounds have been defined and several chemically compatible reinforcement materials have been identified.

882 (N–89-25332) **Absorbed dose thresholds and absorbed dose rate limitations for studies of electron radiation effects on polyetherimides.** Long, E.R. Jr.; Long, S.A.T.; Gray, S.L.; Collins, W.D. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Aug 1989. 22p. (NASA-TP–2928;L–16585;NAS–1.60:2928). Available from NTIS, PC A03/MF A01.

The threshold values of total absorbed dose for causing changes in tensile properties of a polyetherimide film and the limitations of the absorbed dose rate for accelerated-exposure evaluation of the effects of electron radiation in geosynchronous orbit were studied. Total absorbed doses from 1 kGy to 100 MGy and absorbed dose rates from 0.01 MGy/hr to 100 MGy/hr were investigated, where 1 Gy equals 100 rads. Total doses less than 2.5 MGy did not significantly change the tensile properties of the film whereas doses higher than 2.5 MGy significantly reduced elongation-to-failure. There was no measurable effect of the dose rate on the tensile properties for accelerated electron exposures.

883 (N–89-25746) **Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report.** Mahan, J.E. Colorado Research Development Corp., Fort Collins, CO (USA). 1989. 30p. (NASA-CR–185372;NAS–1.26:185372). Available from NTIS, PC A03/MF A01.

Polycrystalline thin films of $CrSi_2$, $LaSi_2$, and $ReSi_2$ were grown on silicon substrates. Normal incidence optical transmittance and reflectance measurements were made as a function of wavelength. It was demonstrated that $LaSi_2$ is a metallic conductor, but that $CrSi_2$ and $ReSi_2$ are, in fact, narrow bandgap semiconductors. For $CrSi_2$, the complex index of refraction was determined by computer analysis of the optical data. From the imaginary part, the optical absorption coefficient was determined as a function of photon energy. It was shown that $CrSi_2$ possesses an indirect forbidden energy gap of slightly less than 0.31 eV, and yet it is a very strong absorber of light above the absorption edge. On the other hand, the $ReSi_2$ films exhibit an absorption edge in the vicinity of 0.2 eV. Measurements of the thermal activation energy of resistivity for $ReSi_2$ indicate a bandgap of 0.18 eV. It is concluded that the semiconducting silicides merit further investigation for development as new silicon-compatible infrared detector materials.

884 (N–89-26198) **Development of a unique laboratory standard: Indium gallium arsenide detector for the 500-1700 nm spectral region. Final report.** EPITAXX, Inc., Princeton, NJ (USA). Aug 1987. 42p. (NASA-CR–183420;NAS–1.26:183420). Available from NTIS, PC A03/MF A01.

A planar (5 mm diameter) indium gallium arsenide detector having a high (greater than 50 pct) quantum efficiency from the visible into the infrared spectrum (500 to 1700 nm) was fabricated. Quantum efficiencies as high as 37 pct at 510 nm, 58 pct at 820 nm and 62 pct at 1300 nm and 1550 nm were measured. A planar InP/InGaAs detector structure was also fabricated using vapor phase epitaxy to grow device structures with 0, 0.2, 0.4 and 0.6 micrometer thick InP caps. Quantum efficiency was studied as a function of cap thickness. Conventional detector structures were also used by completely etching off the InP cap after zinc diffusion. Calibrated quantum efficiencies were measured. Best results were obtained with devices whose caps were completely removed by etching. Certain problems still remain with these detectors including non-uniform shunt resistance, reproducibility, contact resistance and narrow band anti-reflection coatings.

885 (N–89-26739) **Molecular beam epitaxial growth of high-quality InSb on InP and GaAs substrates.** Oh, J.E.; Bhattacharya, P.K.; Chen, Y.C.; Tsukamoto, S. Michigan Univ., Ann Arbor, MI (USA). 1989. 17p. (NASA-CR–185440;NAS–1.26:185440). Available from NTIS, PC A03/MF A01.

Epitaxial layers of InSb were grown on InP and GaAs substrates by molecular beam epitaxy. The dependence of the epilayer quality on flux ratio, J sub Sb4/J sub In, was studied. Deviation from an optimum value of J sub Sb4/J sub In (approx. 2) during growth led to deterioration in the surface morphology and the electrical and crystalline qualities of the films. Room temperature electron mobilities as high as 70,000 and 53,000 sq cm /V-s were measured in InSb layers grown on InP and GaAs substrates, respectively. Unlike the previous results, the conductivity in these films is n-type even at T = 13 K, and no degradation of the electron mobility due to the high density of dislocations was observed. The measured electron mobilities (and carrier concentrations) at 77 K in InSb layers grown on InP and GaAs substrates are 110,000 sq cm/V-s (3 x 10(15) cm(-3)) and 55,000 sq cm/V-s (4.95 x 10(15) cm(-3)), respectively, suggesting their application to electronic devices at cryogenic temperatures.

886 (N–89-26740) **Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates.** Oh, J.E.; Chen, Y.C.; Bhattacharya, P.K.; Tsukamoto, S. Michigan Univ., Ann Arbor, MI (USA). 1989. 19p. (NASA-CR–185439;NAS–1.26:185439). Available from NTIS, PC A03/MF A01.

Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates are discussed. The crystals are all n-type at 300 K and lower temperatures. The surface morphology and electrical characteristics are strongly dependent on Sb(4)/In flux ratio and substrate temperature. The highest mobilities in InSb on InP are 70,000 at 300 K and 110,000 cm(2)/V.s (n=3x10(15) cm(-3)) at 77 K. The mobilities in the alloys also increase monotonically with lowering of temperature. Good quality InAs(x)Sb(1-x) was grown directly on InP substrates by molecular beam epitaxy.

887 (ORNL/tr–89-47) **Molybdenum disilicide as a component of modern composites for application at high temperatures.** Schlichting, J. 41p. Translated from High Temperatures - High Pressures (UK). *High Temperatures - High Pressures (UK)*, 10: 241-269 (1978). Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400.

Molybdenum disilicide, a high-melting, intermetallic compound that has been known to chemists for 70 years, has attained technical significance as a heating conductor material for operating temperatures as high as 1700°C because of its excellent chemical resistance when heated in air. Recent research has shown that the combination of this oxidation-resistant and corrosion-resistant material as a protective coating with heat-resistant metals appears feasible. In the present paper a comprehensive report on this development is given. 177 refs., 30 figs., 3 tabs.

888 (PB–89-216139/XAB) **Substrate heating for the formation of silicon-on-insulator structures by oxygen implantation. Final report.** Spire Corp., Bedford, MA (USA). Nov 1986. 31p. (FR–60071). Available from NTIS, PC A03/MF A01.

A study of the effect of very-high-dose-rate implantation of oxygen into silicon was made. Investigated were possible techniques for increasing throughput for the production of buried oxide layers to make silicon-on-insulator structures. The work utilized dose rates approximately 6 times greater than typical values. Substrates were correspondingly heated to 900-1000 C. At the highest rates, the silicon superficial layer was observed to delaminate at a total dose

corresponding to the formation of stoichiometric silicon dioxide. Surface pitting was also observed at intermediate dose rates and temperatures, when no capping layer was used. No apparent damage was observed prior to the existence of the buried layer, suggesting that very high dose rates can be sustained during the majority of the implantation cycle.

889 (PB–89-218358/XAB) **Low-temperature thermal conductivity of composites: Alumina fiber/epoxy and alumina fiber/PEEK.** Rule, D.L.; Sparks, L.L. National Inst. of Standards and Technology (NEL), Boulder, CO (USA). Chemical Engineering Science Div. May 1989. 58p. (NISTIR–89/3914). Available from NTIS, PC A04/MF A01.

The thermal conductivities of poly-ether-ether-ketone (PEEK), of alumina fiber in a matrix of PEEK, and of alumina fiber in a matrix of epoxy, were determined along with the effects of fiber orientation and thermal cycling. Thermal conductivity was measured over the temperature range of 4.2 to 310 K using a steady-state apparatus. Data are presented and discussed relative to specimen characteristics. It appears that, after accounting for different fiber fractions in the specimens, the thermal conductivity of the PEEK composite material is less than that of the epoxy composite material in particular temperature ranges.

890 (PB–89-230015/XAB) **Inorganic composite materials in Japan: Status and trends.** Koczak, M.J.; Prewo, K.; Mortensen, A.; Fishman, S.; Barsoum, M. Drexel Univ., Philadelphia, PA (USA). Sep 1988. 73p. Available from NTIS, PC EE04/MF A01.

Japan's high-performance composite research activities and applicatcns are reviewed by six authors, who teamed as a study group in September 1988, in order to assess selected research areas of composite activities. The summary of the study group visits are detailed in the subsequent sections: advanced-composite material programs; ceramic fibers and whiskers; metal-matrix composites; ceramic matrix composites; and composite applications and future directions. Several developments in high-temperature metals and polymer and metal-matrix composites have been achieved over an eight-year program. In the composites area, the areas of fiber and whisker developments, ceramic-powder processing, and applications of metal-matrix composites are particularly notable and are reviewed. Toyota's application of wear-resistant metal-matrix composites for automotive-diesel piston fabrication continues to be significant with other structural and wear applications currently being considered and sought. The efforts in ceramic-matrix composites are more on a laboratory and developmental stage and have not matured to a manufacturing production stage with the notable exception of the Nissan turbocharger.

891 (PB–89-864144/XAB) **Electrical-insulating-materials deterioration. January 1970-July 1989 (Citations from the COMPENDEX data base). Report for January 1970-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 121p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the changes in insulating properties of materials due to aging, contaminants, water, ozone, weathering, flashover, and general decomposition. Insulation applications range from use in high voltage cables to winding insulation of transformers and motors. Testing methods and standards are included along with test results and analyses. (Contains 270 citations fully indexed and including a title list.)

892 (PB–89-869663/XAB) **Photochromic materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 71p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867676.

This bibliography contains citations of selected patents concerning methods of producing and applying photochromic materials including photochromic glasses and lenses. Photochromic materials for manufacturing recording, display, and detecting devices and systems are discussed. Photochromic devices for the protection of eyes such as sunglasses and welding masks are considered. (This updated bibliography contains 171 citations, 12 of which are new entries to the previous edition.)

893 (PB–89-869861/XAB) **Flame retardant polymeric foams: Manufacturing, applications, and hazards. July 1984-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for July 1984-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 150p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867460.

This bibliography contains citations concerning flame-retardant compositions and additives used in the manufacture of polymeric foams. Latex, polyurethane, polyether, silicone rubber, phenol formaldehyde, polyisocyanurate, polystyrene, PVC and polyphenylene ether are among the foam polymers discussed relative to tests performed to evaluate the toxicity of flame retardants in smoke and during manufacturing. Applications including public transportation, furniture, automotive, medical, and building materials are discussed. (This updated bibliography contains 303 citations, 61 of which are new entries to the previous edition.)

894 (PB–89-869960/XAB) **Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 90p. Available from NTISPC N01/MF N01.

Supersedes PB–87-865374.

This bibliography contains citations concerning pyroelectric device technology and properties of the pyroelectric materials. Fabrication techniques, testing, and analysis of pyroelectric devices are discussed. Characteristics and defects of pyroelectric materials are examined. Applications in fire and intruder alarms, radiation detection, remote control, gas analysis, and level sensing are presented. (This updated bibliography contains 173 citations, 23 of which are new entries to the previous edition.)

895 (SAND–89-0501) **Fabrication of a laminate structure for a geophysical electrical simulator.** Baca, P.M.; Smith, A.E. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 23p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90001801. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report we describe the development of an unconventional fabrication process using traditional printed-circuit-board materials for assembly into a geophysical electrical simulator. This simulator serves as a bench top geophysical electrical simulation facility for studying and validating dc and very-low-frequency geophysical responses of interest in geologic formations. Soft copper sheet was laminated to glass/epoxy prepreg, without the use of brown oxide coating or any other adhesion promoter, to form a triangle of compound curvature. These triangles were instrumented by the Advanced Process Technology Division and were then assembled into the final hemisphere by the Organic Materials Division. The back side of the hemisphere assembly was encapsulated in polyurethane foam to provide a rigid structure. 1 ref., 10 figs.

896 (SAND–89-2441C) **Predictive aging of elastomers in air: The importance of understanding diffusion-limited oxidation effects.** Gillen, K.T.; Clough, R.L. Sandia National Labs., Albuquerque, NM (USA). [1989]. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910267–1: American Chemical Society Rubber Division national meeting, Detroit, MI (USA), 18 Oct 1989). Order Number DE90001385. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Whenever a new elastomer is formulated or an old formulation is modified, it is important to estimate the material's anticipated lifetime in various use environments. For extended lifetimes (years) this often requires the application of accelerated aging techniques which typically involve the modelling of results obtained at higher-than-ambient environmental stress levels. For many practical applications of elastomers, air is present during environmental exposures – this usually implies that important oxidation effects underly the degradation of the material. Unfortunately, exposure of elastomers to air during aging often results in inhomogeneously oxidized samples, a complication which impacts attempts both to understand the oxidation process and to extrapolate accelerated exposures to long-term conditions. As has been clear for many years,

in order to confidently extrapolate shorter-term accelerated simulations to long-term, air-aging conditions, one must be able to monitor and quantitatively understand diffusion-limited oxidation effects. In this review we will highlight some of the recent developments in both experimental techniques and theoretical modelling of relevance to this goal. 28 refs., 12 figs.

897 (WSRC-RP--89-386) **Use of borosilicate glass in fissile operations at Savannah River (U).** Chandler, M.C. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891118--2: International meeting on nuclear criticality safety margins, San Francisco, CA (USA), 26 Nov - 1 dec 1989). Order Number DE89014146. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Naval Fuel facility, located at the Savannah River Site, manufacturers fuel for the Naval Reactor program. The facility incorporates the use of six-inch-diameter borosilicate glass columns manifolded together for the majority of the fissile solution processing and storage. The use of the glass and the reliance on the natural neutron poisons in the glass, specifically ^{10}B, allows for a larger diameter column vessel and a closer column spacing than most other columnar vessel configurations. The use of the glass has resulted in a greater reliance on the materials of construction and a fewer administrative controls, while providing an adequate margin of safety for facility operation. 7 refs., 6 tabs.

898 **The odyssey of thin-film amorphous silicon photovoltaics.** Sabisky, E.S. (Solar Energy Research Inst., Golden, CO (USA)); Stone, J.L. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A new semi-conductor material, hydrogenated amorphous silicon, emerged in the 1970s; its commercial impact on high technology will be felt for a long time. In the past decade, the authors have seen steady improvements in a-Si:H solar-cell efficiencies; continuous increases in the size and efficiencies of modules; a growing PV market share, to 38%; reduced module costs; plans announced to build 10-MW_p module processing plants; and a growing interest in non-PV applications, particularly thin-film devices for displays and electronic input/output devices. This paper is a brief review of the successes of the technology, and the status of device efficiencies, markets, and commercialization. It also proposes technological goals for the years 1995 to 2000 as well as an approach to achieving these goals.

899 **Molecular-dynamics simulation of thin-film growth.** Schneider, M. (Argonne Nat. Lab., Argonne, IL); Schuller, I.K.; Rahman, A. pp. 811 of Interfaces, superlattices, and thin films. Dow, J.D.; Schuller, I.K Materials Research Society, Pittsburgh, PA (1987). (CONF-8612131--: Materials Research Society symposium on interfaces, superlattices and thin films, Boston, MA (USA), 1-6 Dec 1986).

The epitaxial growth of thin films has been studied by molecular-dynamics computer simulation. In these simulations atoms are projected towards a temperature-controlled substrate, and the equations of motion of all atoms are solved for a given interaction potential. The calculations give insight into the microscopic structure of thin films, the dynamics of the adsorption process, and they help answer the way in which substrate temperature, form of the substrate, flux of impinging atoms, and form of the interaction potential, affect epitaxial growth. Simulations were performed for monatomic and binary systems with spherically symmetric atomic interactions, and for systems in which the atoms are interacting via a three-body potential to simulate the epitaxial growth of silicon.

900 **Recent results on ion-beam hydrogenation of amorphous silicon.** Tsuo, Y.S. (Solar Energy Research Inst., Golden, CO (USA)); Xu, Y.; Mascarenhas, A.; Deb, S.K.; Barua, A.K. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The authors have studied the ion-beam hydrogenation of undoped amorphous silicon obtained by dehydrogenation of glow-discharge-deposited a-Si:H, by glow-discharge deposition of 480^{0}C, and by radio-frequency magnetron-sputter deposition. Highly photosensitive a-Si:H films with up to 20 at .% hydrogen bonded predominantly as monohydrides have been obtained. This paper reports results of Raman scattering measurements of magnetron-sputtering-deposited amorphous silicon before and after hydrogenation, comparisons of ion-beam and RF posthydrogenation techniques, and a possible application of the ion-beam hydrogenation technique.

901 **Electrochemical and galvanic corrosion effects in thin-film photovoltaic modules.** Mon, G. (Jet Propulsion Lab., Pasadena, CA (USA)); Wen, L.; Meyer, J.; Ross, R. Jr.; Nelson, A. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

In this paper the electrochemical and galvanic corrosion properties of thin-film photovoltaic (TF-PV) module and module subcomponents are determined and interpreted in light of established corrosion science. Results of a detailed study of thin-film aluminum metallization corrosion are presented. Bar-graph corrosion, observed in fielded modules, has been experimentally induced and determined to be electrochemical in nature. Corrosion rates and passivation techniques for TF-PV modules are discussed.

902 **Dangling-bond states in a-Si,Ge:H,F measured by temperature-dependent μtau.** Shen, D.S. (Princeton Univ., NJ (USA). Dept. of Electrical Engineering and Computer Science); Conde, J.P.; Chu, V.; Liu, J.Z.; Maruyama, A.; Aljishi, S.; Smith, Z.E.; Wagner, S. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The authors report a new technique for measuring the density distribution of the D^0-/state in a-Si:H before and after light soaking and in a-Si,Ge:H,F alloys. Electron time-of-flight (TOF) measurements as a function of temperature from the basis of their new technique. The deep trapping of electrons controls the mobility-lifetime product $(\mu\tau)_n$, which is evaluated from the integrated TOF current. The dominant deep trap is the D^0-/level. The authors obtain the density of D^0-/states in a-Si,Ge:H,F which peak at E_c-(0.40 to 0.45) eV, with maxima in the 10^{18} to 10^{19} $cm^{-3}eV^{-1}$ range. In a-Si:H, the peak lies at E_c-0.45 eV; they observe its growth with increasing light-soaking time.

903 **Time resolved fluorescence line narrowing in ytterbium-doped inorganic glasses.** Brundage, R.T. (Univ. of Wisconsin-Madison, Dept. of Physics, 1150 Univ. Ave., Madison, WI (US)); Yen, W.M. vp of Defects in glasses. Galeener, F.L.; Griscom, D.L.; Weber, M.J. Materials Research Society, Pittsburgh, PA (1986). (CONF-851217--: Materials Research Society meeting, Boston, MA (USA), 2-7 Dec 1985).

The authors used time resolved fluorescence line narrowing to study optical dephasing and energy transfer among Yb^{3+} ions doped inorganic glasses. They observe for the first time in any rare earth doped glass system a change in the power of the temperature dependence of the homogeneous linewidth of the $^2F_5 2/(1)$-$^2F_7 2/(1)$ transition of Yb^{3+} as well as an efficient one-phonon assisted energy transfer process occurring among Yb^{3+} ions higher concentration due to a quadrupole-quadrupole coupling of the ions. In this paper, the authors review past studies in rare earth doped glass systems of these topics and compare them to their observations of Yb^{3+} in silicated and phosphate glasses.

904 **Doping dependence of minority carrier lifetime in Ga-doped silicon.** Pang, S.K. (Georgia Inst. of Tech., Atlanta, GA (USA). School of Electrical Engineering); Rohatgi, A.; Ciszek, T.F. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965--: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

This paper presents a combination of detailed measurements and modeling to shed light on the lifetime limiting centers and mechanisms in high-lifetime (~1 ms) Ga-doped float zone silicon. A deep

level at E_c-0.52 eV was found to limit the lifetime in high quality silicon used in this study prior to intentional doping. Initial addition of Ga dopant ($5.5x10^{14}cm^{-3}$) increases the trap density and trap assisted Auger coefficient by a factor of four, which remains unchanged with further increase in Ga concentration in the range of $6x10^{14}$-$2.6x10^{16}cm^{-3}$. A trap assisted Auger process has been clearly identified and quantified in these samples by DLTS and injection level/doping dependent lifetime measurements, coupled with lifetime modeling. The observed doping/injection level dependence of lifetime explained by a combination of Shockley-Read-Hall, trap assisted Auger, and band-to-band Auger recombinations.

905 **III-V compound process development using photoluminescence lifetime.** Ahrenkiel, R.K. (Solar Energy Research Inst., Golden, CO (USA)); Dunlavy, D.J.; Timmons, M.L. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The development of processing techniques for the $Al_xGa_{1-x}As$ alloys were expedited by using photoluminescence lifetime as a process monitor. The active region was part of an isotope double heterostructure. This study shows the variation of lifetime with growth temperature and starting material.

906 **Minority carrier lifetime of GaAs on silicon.** Ahrenkiel, R.K. (Solar Energy Research Inst., Golden, CO (USA)); Al-Jassim, M.M.; Dunlavy, D.J.; Jones, K.M.; Vernon, S.M.; Tobin, S.P.; Haven, V.E. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

AlGaAs/GaAs double heterostructures were grown on heteroepitaxial GaAs/Si layers by MOCVD. These test devices were subsequently characterized by photoluminescence and transmission electron microscopy (TEM).The minority carrier lifetimes were found to be limited by recombination of mismatch dislocations. An inverse correlation between dislocation density and minority carrier lifetime was observed. The use of thick (8μm) GaAs buffer layers in conjunction with thermal annealing of these structures reduced the dislocation density of about an order of magnitude. The minority carrier lifetime in these buffered heterostructures increased from 0.1 ns to 2 ns.

907 **Ultralong minority-carrier lifetime epitaxial GaAs by photon recycling.** Ahrenkiel, R.K. (Solar Energy Research Institute, Golden, Colorado 80401 (US)); Dunlavy, D.J.; Keyes, B.; Vernon, S.M.; Dixon, T.M.; Tobin, S.P.; Miller, K.L.; Hayes, R.E. *Applied Physics Letters (USA)*, 55(11): 1088-1090 (11 Sep 1989).

The minority-carrier lifetime has been measured by time-resolved photoluminescence in epitaxial films of GaAs grown by metalorganic chemical vapor deposition. The measured lifetimes in thicker devices are 4 to 6 times the theoretical or radiative lifetime. These long lifetimes are the result of photon recycling or self-generation of the self-absorbed radiation.

908 **Nonlinear elasticity of amorphous solids.** Golubovic, L. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396 (US)); Lubensky, T.C. *Physical Review Letters (USA)*, 63(10): 1082-1085 (4 Sep 1989).

Structural phase transitions in amorphous solids associated with vanishing bulk modulus K or shear modulus μ are considered. We find that the transition (realized in gels) at K=0, though of second order, does not exhibit true scaling behavior of density fluctuations. An isotropic state with vanishing μ is unstable to the formation of an anisotropic glassy phase that has a phonon spectrum exhibiting soft directions in momentum space similar to those in liquid crystals. The effects of internal random stresses are studied.

909 **Carrier-lifetime control of photochemical dry etching using elevated impurity concentrations.** Ashby, C.I.H. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Myers, D.R.; Vawter, G.A.; Biefeld, R.M. *Applied Physics Letters (USA)*, 55(11): 1127-1128 (11 Sep 1989). DOE Contract AC04-76DP00789.

Virtually total suppression of carrier-driven photochemical etching of semi-insulating GaAs, *n*-GaAs, and n^+-GaAs has been achieved by indiffusion of Zn to a surface carrier concentration greater than $10^{20}/cm^3$. This technique for photochemical reaction suppression can be used as a self-aligned etching technology for semiconductor device fabrication.

910 *In situ* **spectroscopic measurements of erosion behavior of Tokamak Fusion Test Reactor-redeposited carbon materials under high-flux plasma bombardment in PISCES-A (Plasma Interactive Surface Component Experimental Station-A).** Hirooka, Y. (Department of Mechanical, Aerospace and Nuclear Engineering, Institute of Plasma and Fusion Research, University of California, Los Angeles, Los Angeles, California 90024 (US)); Pospieszcyk, A.; Conn, R.W.; Mills, B.; Nygren, R.E.; Ra, Y. *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films (USA)*, 7(5): 2935-2942 (Sep 1989).

The chemical erosion behavior of graphite materials preexposed in the Tokamak Fusion Test Reactor (TFTR) as the bumper limiter has been investigated spectroscopically under deuterium plasma bombardment in the Plasma Interactive Surface Component Experimental Station-A (PISCES-A) facility. The deuterium plasma bombardment conditions are ion bombarding energy of 300 eV, ion flux of 1.7×10^{18} ions s^{-1} cm^{-2}, plasma density of 1.4×10^{12} cm^{-3}, electron temperature of 11 eV, and neutral pressure of 3×10^{-4} Torr. The chemical erosion yield is measured with calibrated CD-band spectroscopy during the temperaure ramp from 100 to 900 °C at an average rate of ~5 K/s. The materials used include virgin POCO graphite and graphite tile pieces from the redeposited and eroded areas of the bumper limiter of TFTR. The deuterocarbon formation rate from TFTR redeposits maximizes at ~500 °C. Essentially the same chemical erosion behavior is observed for TFTR-eroded and virgin graphites and is characterized by the compound peak, indicative of two erosion yield maxima at around 575 and 700 °C. The maximum erosion yield for TFTR redeposits is found to be ~15% higher than those of TFTR-eroded and virgin POCO graphites which is attributed to deuterium incorporated in the redeposited material. In addition, the removal behavior of redeposits by helium plasma bombardment has been studied. The removal rate is evaluated to be similar to the physical sputtering yield of carbon by helium. The surface morphology and surface composition have been analyzed with scanning electron microscopy and electron microprobe analysis along with these erosion yield measurements.

911 **Monte Carlo study of photogenerated carrier transport in GaAs surface space-charge fields.** Zhou, X. (Department of Electrical Engineering and Laboratory for Laser Energetics, University of Rochester, Rochester, New York 14627 (US)); Hsiang, T.Y.; Miller, R.J.D. *Journal of Applied Physics (USA)*, 66(7): 3066-3073 (1 Oct 1989).

A self-consistent ensemble Monte Carlo particle model to simulate the dynamics of photogenerated carrier transport in GaAs surface space-charge fields is presented. Dependence of transport parameters, such as relaxation processes, carrier screening, and velocity overshoot, on pulse width, injection level, and excitation energy is investigated and related to the experimentally observable potential drop across the surface space-charge region. In the present study, the high-field conditions are produced by charged surface states, and are to be modified by the redistribution of injected carriers. The photocarrier-induced change in the electric field, which can be measured using electro-optic sampling techniques, is found to be due to the spatial separation of the electron-hole pairs. The simulation results show that at a high injection level a maximum potential drop would result due to complete carrier screening of the surface charge field. The rate of change of this potential drop also would increase with increasing level of injection. These results are in good qualitative agreement with experimental observations. The simulation predicts an enhanced degree of velocity overshoot at decreasing injection energies and, at below L-minima excitation, a second increase in the potential resulting from the redistribution of carriers in the bulk. In this way, it is indicated that the study of the onset of photoconductivity can be used to probe such transport properties in GaAs.

912 **Harmonic generation with ultrashort pulses using nonlinear poled polymeric thin films.** Mortazavi, M.A. (University

of California, Davis, Department of Electrical Engineering & Computer Science, Davis, California 95616 (US)); Yankelvich, D.; Dienes, A.; Knoesen, A.; Kowel, S.T.; Dijaili, S. *Applied Optics (USA)*, 28(16): 3278-3280 (15 Aug 1989).

An organic thin film is successfully utilized as the second harmonic element in an autocorrelation measurement of ultrashort 200-fs optical pulses.

913 **Layer-by-layer growth of solid argon films on graphite as studied by neutron diffraction.** Larese, J.Z. (Brookhaven National Laboratory, Upton, New York 11973 (US)); Zhang, Q.M.; Passell, L.; Hastings, J.M.; Dennison, J.R.; Taub, H. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4271-4275 (1 Sep 1989). DOE Contract AC02-76CH00016.

The layer-by-layer growth of solid argon films on graphite at T=10 K is studied using elastic neutron diffraction. The growth is characterized by individual layers with commensurate in-plane lattice constants. As the coverage is increased beyond two layers, evidence of the coexistence of *ABC* and *ABA* stacking is apparent, with the *ABC* sequence dominating as the film thickens. A continuous decrease in the Debye-Waller factor also occurs as the film thickness grows, indicating a crossover from two-dimensional to three-dimensional behavior. As the coverage is increased beyond about four nominal layers, there is evidence of bulk crystallite formation. The diffraction results are compared with equivalent measurements for methane films and with the recent computer simulations of Hruska and Phillips.

914 **Melting in multilayer adsorbed films.** Pettersen, M.S. (Condensed Matter Physics 114-36, California Institute of Technology, Pasadena, California 91125 (US)); Lysek, M.J.; Goodstein, D.L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 4938-4946 (1 Sep 1989).

We present both an improved model and new experimental data concerning the problem of melting in multilayer adsorbed films. The model treats in a mutually consistent manner all interfaces in a stratified film. This results in the prediction of substrate freezing, a phenomenon thermodynamically analogous to surface melting. We also compare the free energies of stratified films to those of homogeneous films. This leads to an orderly classification of multilayer phase diagrams in the vicinity of the bulk triple point. The results of the model are compared with the experimentally known systems. Of these, only methane/graphite exhibits melting from homogeneous solid to homogeneous liquid in multilayer films. The systems Ne/graphite and Ar/graphite, studied by Zhu and Dash, exhibit surface melting and substrate freezing instead. We observe experimentally, by means of pulsed nuclear magnetic resonance, that melting in methane adsorbed on graphite extends below the film thickness at which the latent heat of melting is known to vanish. The multilayer melting curve in this system is a first-order prewetting transition, extending from triple-point dewetting at bulk coexistence down to a critical point where the latent heat vanishes at about four layers, and apparently extending to thinner films as a higher-order, two-dimensional phase transition. It would therefore seem that methane/graphite is an ideal system in which to study the evolution of melting from two dimensions to three dimensions.

915 **Subnanosecond x-ray diffraction from laser-shocked crystals.** Wark, J.S. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299 (US)); Whitlock, R.R.; Hauer, A.A.; Swain, J.E.; Solone, P.J. *Physical Review [Section] B: Condensed Matter (USA)*, 40(8): 5705-5714 (15 Sep 1989).

Multikilobar shocks were launched into single crystals of (111) silicon with a 1-ns pulse (full width at half maximum) of 1.06-μm light at an irradiance of 10^9–10^{10} W cm^{-2} using the JANUS research laser at Lawrence Livermore National Laboratory. Transient strains on the order of several percent were thus introduced into the crystal. During the compression of the crystal a short (100 ps) intense burst of x-ray line radiation was produced by focusing a second laser beam, synchronous but delayed with respect to the shock-driving beam, onto a solid target. The x rays were Bragg diffracted from the surface of the shocked crystal, and recorded on x-ray film. The spectral brightness of the x rays was sufficient to allow data to be recorded on a single laser shot. The shift in the Bragg angle with compression allows the interatomic spacings to be directly measured in the shocked region. A sequence of shots at various delay times and laser irradiances was recorded, mapping the interatomic spacing as a function of time. Compression above the Hugoniot elastic limit was achieved, with evidence of single-crystal nature being preserved. The compression results are in good agreement with calculations based on hydrodynamic-code pressure simulations and dynamical diffraction theory. The relevance of the technique to some of the fundamental problems of shock-wave physics and phase transitions is discussed.

40 CHEMISTRY

916 (INIS-SU–128) **Physicochemical fundamental of chemical fundamentals of chemical technology. Issue 150. Proceedings of Institute.** Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1988. 177p. (In Russian). Order Number DE90705935. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Individual items in scope for the data base are processed separately. (DLC)

4001 Analytical and Separations Chemistry

Refer also to citation(s) 18, 24, 25, 111, 112, 123, 969, 1187, 1337, 1349, 1447, 1545

917 (CONF-891013–5) **Conversion of enriched isotopes of sulfur from SF_6 to a suitable compound for feed to the electromagnetic calutron separators.** Caudill, H.H.; Bond, W.D.; Collins, E.D.; McBride, L.E.; Milton, H.T.; Tracy, J.G.; Veach, A.M.; York, J.W. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989. Order Number DE90001958. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Enriched isotopes of sulfur are becoming attractive for use as tracers in a variety of environmental and scientific experiments. many stages of separation are needed, especially for ^{33}S and ^{36}S, which exist in low natural abundances. Small amounts of highly enriched sulfur isotopes can be provided by means of electromagnetic separation in the calutrons. However, the cost is prohibitively high for enrichment of large amounts needed by many experiments. Thus, a two-stage process is planned to obtain large amounts using gas centrifuges for preenrichment, followed by final enrichment in the calutrons. Sulfur hexafluoride is the most efficient form for processing sulfur in the centrifuges; however, SF_6 is unacceptable as feed to the calutrons because it has excellent insulating properties for the high voltage apparatus used to ionize the feed. An efficient process is needed to convert the preenriched sulfur isotopes from SF_6 to a suitable form for calutron feed. Development of a process is difficult because of the relatively high stability of SF_6. Reiner and Simmons have successfully converted SF_6 to SO_2 in pilot studies using a propane/oxygen flame reactor. However, H_2S is a more desirable intermediate for producing metal sulfides or sulfur halides. Thus, experiments have been made using direct hydrogenation at temperatures of >900°C. Conversion to cadmium sulfide has been accomplished by scrubbing the H_2S product gas with 5% $CdCl_2$ and product yields of >90% have been achieved. A developmental program to convert SF_6 to CdS, or another more efficient form is being carried out. Optimum conditions for the conversion are being determined and the products are being evaluated in calutron test runs. 7 refs., 5 figs., 2 tabs.

918 (DOE/ER/13881–2) **Development of laser excited atomic fluorescence and ionization spectrometric methods: Progress report, January 1, 1989–October 1, 1989.** Winefordner, J.D. Florida Univ., Gainesville, FL (USA). Dept. of Chemistry. [1989]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13881. Order Number DE90001567. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the past nine months, we have been involved with four exciting research topics: (1) theoretical considerations and estimations

concerning the ultimate detection power of laser fluorescence and laser ionization techniques; (2) experimental evaluation of laser excited atomic fluorescence spectrometry with electrochemical atomization; (3) the development of the theory for resonance ionization detection of weak fluorescence radiation; and (4) evaluation of the analytical capabilities of laser excited fluorescence of atoms in glow discharges. This report briefly discusses the progress, in each of the afore mentioned topics.

919 (DPT–132) **Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium.** Zhang Qingxuan; Zhang Jiajun; Tian Baosheng; Jiang DongLing; Li Zhaoyi; He Jianyu. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). [1989]. 23p. Translation of CNIC-00137; IAE-0035, January 1988. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90001713. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The electrolytic behavior of Np(V)-Np(V1) in HNO_3 media was investigated. It was demonstrated experimentally that the electrolytic process is reversible. The reduction of Np(V) has very high overpotential. In double (region?) compartment single stage electrolytic cell* with cathode potential of 700 mV (S.C.E), Np(V1) can be quantitatively reduced to Np(V) in 10 minutes. In the medium of 1.50 mol/1 HNO_3, the reaction half-time for the electrolytic reduction of Np(V1) is about 1.5 minutes. It can be foreseen that the neptonium in the mixing-settling cell (M-S battery?) is in the tetravalent state. The purpose, design and trial test of the electrolytic reduction mixing-settling cell with anode cathode co-chamber and the cold running of uranic acid are discussed. Such a cell was used in carry out the trial run of co-existing uranium, plutonium and neptonium, emphasizing the behavior of neptonium during the uranium and plutonium separation process. Experimental results indicate that the Pu recovery (yield) is 99.90-99.99%, the separation coefficient for Pu from U is 3900 ~33000 and material balance of U, Pu, and acid is good. There is serious accumulation and inside recycling of neptonium in the cell. The neptonium in the cell is mainly in the tetravalent state. Under the conditions for U-Pu separation in 1B cell, it is very unlikely to recover neptonium quantitatively from the single product fluent (IBU or IBP).

920 (INIS-BR–1611) **Geochemical study of main elements and trace elements in soils of three profiles in the state of Santa Catarina.** Santelli, R.E. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). 1985. 133p. (In Portuguese). Order Number DE90606121. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The total concentrations of the main components (Si, Al, Fe, Ca, Mg, Mn, Ti, Na and K) and of nine trace elements Ba, Co, Cu, La, Li, Mo, Ni, V and Zn are measured. The elements are determined by several atomic absorption and emission spectroscopic methods. Some properties such as granulometry, mineralogy of the clay fraction, organic matter, etc., are studied. (M.J.C.).

921 (INIS-BR–1624, pp. 96) **Muon induced fission and fission track dating.** Marques, A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil)). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MUSCOVITE/age estimation; MUSCOVITE/fission tracks; MUON REACTIONS; MUSCOVITE

922 (INIS-BR–1633) **Uranium (VI) determination by Radiometric Stripping Analysis (X ray).** Nobrega, A.W. da; Silva, C.R.R. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1989. 1p. (In Portuguese). (CONF-8909241–: 5. Brazilian meeting on analytical chemistry, Salvador (Brazil), 4-6 Sep 1989). Order Number DE90606127. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM/x-ray fluorescence analysis; URANIUM

923 (INIS-BR–1634) **Specification and characteristics of ion selective electrode for uranium (VI).** Nobrega, A.W. da; Silva, C.R.S.; Henriques, H.P. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1989. 1p. (In Portuguese). (CONF-8909241–: 5. Brazilian meeting on analytical chemistry, Salvador (Brazil), 4-6 Sep 1989). Order Number DE90606173. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRODES/specifications; URANIUM/ion selective electrode analysis; ELECTRODES; SPECIFICATIONS; HYDROCHLORIC ACID; URANIUM

924 (INIS-BR–1653) **Determination of uranium (IV) in cloride solutions of enrichment columns by spectrometry with flow injection.** Bastos, M.B.R. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica. 1988. 112p. (In Portuguese). Order Number DE90606186. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The utilization of Flow Injection Analysis for the U (IV) spectrophotometric determination in chloride solutions is described. The method has been shown reproducible in the range of concentrations and conditions employed with a standard deviation of about 0,3. (C.G.C.).

925 (INIS-BR–1655) **Thorium determination by X-ray Fluorescence Spectrometry in simulated thorex process solutions.** Yamaura, M.; Matsuda, H.T. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Dept. de Engenharia Quimica. 1989. 32p. (In Portuguese). Order Number DE90606134. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The X-ray fluorescence method for thorium determination in aqueous and organic (TBP-n-dodecane) solutions is described. The thin film-technique for sample preparation and a suitable internal standard have been used. Some parameters as analytical line, internal standard, filter paper, paper geometry, sample volume and measurement conditions were studied. Uranium, fission products, corrosion products and thorex reagent components were studied as interfering elements in the thorium analysis, as well as the matrix effect by using the thorex process simulated solutions the method to thorium determination in irradiated thorium solutions was applied. (M.J.C.).

926 (INIS-BR–1657) **Uranium determination in $UO_2(NO_3)_2$-HNO_3-H_2O system by precision densimetry.** Alem, M.C.; Matsuda, H.T.M.; Araujo, B.F. de; Araujo, J.A. de. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1983. 21p. (In Portuguese). (CONF-8310455–: 26. Brazilian Congress of Chemistry, Sao Paulo (Brazil), 10-15 Oct 1983). Order Number DE90606175. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A method for uranium determination by digital density measurements is presented. The method is based on the variation of a hollow oscilator natural frequency when filled with a sample. A simple relationship between the density of the solution and the frequency is described. (M.J.C.).

927 (INIS-BR–1658) **Chemical analysis by X-ray fluorescence, of niobium in high-strength plate steels.** Iozzi, F.B.; Dias, M.J.P. Associacao Brasileira de Metais, Sao Paulo, SP (Brazil). 1981. 7p. (In Portuguese). (CONF-8110302–: 2. seminar on physical metallurgy and heat treatments, Rio de Janeiro (Brazil), 1-2 Oct 1981). Order Number DE90606135. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The use of X-ray fluorescence spectrometry in quantitative analysis of niobium in steels, as an alternative solution for optical emission spectrometry, in the rapid chemical control of steel fabrication by LD type converters, is presented. (M.C.K.).

928 (INIS-BR–1668) **Addition compounds between lanthanide trifluoromethane sulphonates and N,N,N',N' - tetrametilmalonamida (TMMA).** Bellis, V.M. de. Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1984. 226p. (In Portuguese). Order Number DE90606187. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

The preparation and characterization of the addiction compounds between lanthanide trifluoromethanesulphonates with the N,N,N',N' - tetramethylmodomamide (TMMA) are reported. The characterization of the compounds obtained by microanalytical procedures, infrared

spectra, conductance measurements, X-ray powder patterns, absorption spectra of the praseodymium, neodymium, holmium and erbium and the emission spectra of the europium and the europium-doped lanthanum and lutetium adducts were made. (M.J.C.).

929 (INIS-BR–1671) **Optimization of transmission method for using in safeguards.** Almeida, M.C.M. de; Baptista, H.; Bezerra, J.H.B. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90606136. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. GAMMA RADIATION/uranium 235; URANIUM 235/gamma radiation; URANIUM 235/quantity ratio; OPTIMIZATION; SAFEGUARDS

930 (INIS-BR–1677) **Determination of U^{235} enrichment from nuclear fuel by neutronic activation.** Almeida, M.C.M. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Quimica. 1988. 96p. (In Portuguese). Order Number DE90606137. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The enrichment of ^{235}U in UO_2 pellets samples through the instrumental neutron activation analysis method (I.N.A.A.) was determined. By high resolution gamma-ray spectrometry (H.R.G.S.), from analysis of isotopic ratios between fission products peaks from ^{235}U and ^{239}Np different energies peaks from ^{238}U, the enrichment was achieved. The 'Boatstrap' statistics technique for the analytical results, which is based in shaping results of an unknown distribution to the Gaussian distribution by B replications in interested statistics such as: the mean and its standard error, was introduced. (M.J.C.).

931 (IPEN-PUB–258) **Determination of uranium in urine by 2-spectrometry.** Duarte, C.L.; Szeles, M.S.-M.F. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Jul 1989. 24p. (In Portuguese). Order Number DE90606140. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A comparative study is presented for two technics of preparation sources for the determination of uranium isotopes by α - spectrometry: electrodeposition and chemical stripping with polymeric membrane containing trioctylphosphine oxide (TOPO). A method is described for separation of uranium from urine with an ion-exchange column Dowex 1x8 (chloride form). The mean yield obtained for electrodeposition and TOPO deposition was 74% and 8,5% respectively. The TOPO deposition presented better resolution for ^{238}U and ^{234}U than electrodeposition. The global yield of the method obtained was 50%. (author).

932 (PB–89-168017/XAB) **NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988.** O'Connor, C. National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA). Reactor Radiation Div. Jan 1989. 230p. (NIST/TN–1257). Available from NTIS, PC A11/MF A01.

Also available from Supt. of Docs. as SN003-003-02920-3. See also PB–83-218636.

This report summarizes all those programs which use the NBS Reactor. It covers the period for July 1987 through June 1988. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, neutron radiography, and nondestructive evaluation.

933 (PB–89-201404/XAB) **Improved method for determination of helium-4 in helium-3 by mass spectrometry. Report of investigations/1989.** Burton, S.R.M.; Cornelius, D.E. Bureau of Mines, Amarillo, TX (USA). Helium Field Operations. 1989. 14p. (BUMINES-RI–9232). Available from NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600442.

The U.S. Bureau of Mines report describes a method for determining parts per million (ppm) of helium-4 (He-4) in helium-3 (He-3) to an accuracy of + or - 5% by mass spectrometry. Gravimetrically prepared primary standards were used for the calibration of a Dempster 180° magnetic-sector mass spectrometer. A comparison between a 2.49% He-4 in hydrogen mixture and a 2.49% He-4 in He-3 mixture shows that He-3 can be replaced with hydrogen as a diluent for standards with comparable mass spectrometry sensitivities for He-4. Using hydrogen as a diluent allows analysis of He-3 samples for He-4 when He-3 is not available for preparation of standards and also conserves the rare He-3 isotope. Standards of He-4 in H2 were prepared for calibration of the mass spectrometer for quantitative determinations of He-4 in the 2 to 100 ppm range. A minimum detectable limit of 2 ppm He-4 is obtained by the method.

934 (ZfK–584, pp. 90) **Nuclear micro-beam probe for the investigation of surfaces.** Fromm, W.D.; Grambole, D.; Herrmann, F.; Schwarzenberg, F. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. NUCLEAR REACTION ANALYSIS/camac system; NUCLEAR REACTION ANALYSIS/microanalysis; BEAM SCANNERS; DATA PROCESSING; MICROPROCESSORS; MICROANALYSIS; ON-LINE SYSTEMS; PROBES; SPECIFICATIONS; SURFACES; TWO-DIMENSIONAL CALCULATIONS

935 **Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden.** Ellis, K.J. (Medical Research Center, Brookhaven National Lab., Upton, NY (US)). vp of Trace substances in environmental health-XIX. Hemphill, D.D University of Missouri Extension Information, Columbia, MO (1985). (CONF-8506299–: 19. annual conference on trace substances in environmental health, Columbia, MO (USA), 3-6 Jun 1985).

Differences in uptake, metabolism, and excretion of heavy metals makes selection of a suitable biological media as a monitor of body burden very difficult. Exposure assessments based on body fluid levels can provide, at best, only general population estimates. The most frequently monitored media are blood, urine, nail or hair clippings, sweat, and saliva. Unfortunately each of these tissues can be influenced by recent exposure conditions and are not accurate indices of the total dose or body burden. Direct in vivo measurements of body burden in humans, however, have recently been performed. This nuclear technique has focused on the measurements of kidney and liver cadmium (Cd) by neutron activation analysis and bone lead (Pb) determinations using x-ray fluorescence. The dose-response relationship for renal dysfunction based on the direct in vivo body burden for Cd is presented. The most probable Cd value for the kidney associated with renal impairment is approximately 35 mg. Approximately 10^0% of the subjects with 20 mg Cd in the kidney will have moderately elevated β_2-microglobulin, an early indicator of potential renal functional changes.

4002 Inorganic, Organic and Physical Chemistry

Refer also to citation(s) 15, 1706, 1781

936 (DOE/ER/13454–T4) **Thermodynamics and kinetics of complex organic systems: Progress report, March 15, 1989–March 14, 1990.** Alberty, R.A. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry. Oct 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13454. Order Number DE90002547. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research is briefly described in the following areas: (1) thermodynamics of the formation of benzene series polycyclic aromatic hydrocarbons in a benzene flame; (2) use of semigrand ensembles in chemical equilibrium calculations on complex organic systems; (3) representation of standard chemical thermodynamic properties of isomer groups by equations; (4) derivation of the analytic functions for representing the equilibrium distributions of the successive isomer groups in alkane, alkene, and alkyne homologous series. (CBS)

937 (DOE/FTR–90001319) **[Brief highlights of the Eleventh International vacuum congress]: Foreign trip report, September 23–30, 1989.** Hrbek, J. Brookhaven National Lab., Upton, NY (USA). 11 Oct 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number

DE90001319. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

I attended the Eleventh International Vacuum Congress and delivered a lecture entitled "Interaction of Potassium Overlayers with Oxygen and a Potassium-Dioxygen Complex with Carbon Monoxide." I participated in many coadsorbates and about the adsorption of small molecules on metal surfaces.

938 (GKSS–89/E/10) **Selective pervaporation of organics from water.** Boeddeker, K.W.; Bengtson, G. GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 26p. Available from Preprint from: R.Y.M. Huang (ed.): Pervaporation membrane separation processes, chapter 12, Amsterdam (Netherlands), Elsevier (1989).

The possibility to selectively pervaporate organics from dilute aqueous solution has been amply demonstrated, however, the feasibility to do so on a practical scale has not. To assess pervaporation against established separation processes requires, in addition to proven membrane performance, pilot plant experience on realistic (multi-component) feed mixtures. Specific points of aqueous-organic pervaporation to be evaluated in terms of process design and economic impact are: The effect of downstream pressure on separation performance, particularly when dealing with low volatile organics; phase separation of the condensed permeate, where applicable, as a means to enhance the overall separation effect; condensation of permeates at controlled temperature levels to effect permeate fractionation; low pressure versus carrier gas operation. When applied to pervaporative depletion of wastewaters from organic pollutants, the subsequent treatment of the enriched permeates needs to be considered. As suggested by some of the high separation effects observed, product recovery involving an additional pervaporation stage, under favorable conditions, may be feasible. While for most conceivable applications there are competing separation processes burdening the acceptance of membrane processing, there is one area of application which is unique to pervaporation: The in-situ recovery (and enrichment) of organic products from fermentation broths with the ultimate goal to produce oxychemicals by continuous bio-processing. (orig.).

939 (IKF-IB–72) **Materials research with ion beams. Simulation and analysis.** Meyer, J.D. Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik. 1988. 80p. (In German). Order Number DE90717903. Available from NTIS (US Sales Only), PC A05/MF A01.

Commodore Amiga 2000; FORTRAN 77.

This report gives a series of helpful programs which are used in materials research with ion beams. In this context algorithms which can substitute table books are dealt with. This is true for the programs DEDX and PRAL; they are used in order to determine the energy loss of ions in solid bodies, their working range and straggling. Furthermore, simulator routines and analyzers are described. The program TRIM simulates the physical phenomena which occur with the penetration of high-energy ions into solid bodies. In this context electronic excitations, phonons and lattice distortions which are caused by the ions are dealt with. For the experimental ion implantation it is interesting to know the final distribution of the simulated ions in the solid body. The program RBS simulates the Rutherford spectrum of ions which are scattered from a solid body which may consist of up to nine elements and up to one hundred layers. The unknown composition of a solid body can be determined in direct comparison with the experimental spectrum. The program NRA determines concentration and penetrative distribution of an impurity by means of the experimental nuclear reaction spectrum of this impurity. All programs are written in FORTRAN 77. (orig./MM).

940 (INIS-BR–1660) **Solvents extraction of niobium and tantalum.** Santos, P.R.G.; Cunha, O.C. da. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1982. 8p. (In Portuguese). (CONF-8212117–: 1. meeting of Southern Hemisphere on mineral technology and 9th national meeting on mineral treatment and hydrometallurgy, Rio de Janeiro (Brazil), 5-10 Dec 1982). Order Number DE90606194. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The separation process of niobium and tantalum using solvent extraction is evaluated. The use of methyl isobutyl ketone (MIBK) e tributyl phosphate (TBP), and the distribution of two elements between aqueous and organic phases in function of the fluoridric and sulfuric acids, solvent and diluent is analysed. (M.J.C.).

941 (INIS-SU–128, pp. 164-169) **Kinetics of samarium solvent extraction and stripping in systems with DiOMPh.** Volkovskaya, E.I.; Nikolaeva, T.D.; Rezepov, V.A. Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1988. (In Russian). In *Physicochemical fundamentals of chemical technology. Issue 150. Proceedings of Insttute.* Order Number DE90705935. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

L-68959.

The kinetics of Sm^{3+} extraction with the 75 % DiOMPh solution in decane from nitrate-phosphate media and solid phase stripping from organic DiOMPh solutions by aqueous oxalic acid solutions with the diffusion cell method and stirring, is studied. The effect of solvent and small additions of different modifiers on the rate of samarium mass transfer is considered. It is shown that during stripping with 7% oxalic acid solution the complete Sm^{3+} withdrawal from organic solvents is achieved for 30-40 min. 5 refs.; 3 figs.

942 (INIS-SU–129, pp. 321-322) **Investigation of the influence material on initial stages of epitaxial growth of $Pb_{0.8}Sn_{0.2}Te$ layer during the growing from solution-melt.** Kalinin, A.A. (Gosudarstvennyj Inst. Redkikh Metallov, Moscow (USSR)); Kamkin, A.N.; Lakeenkov, V.M.; Likholetov, A.N.; Shniger, O.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: 7. All-Union conference on crystal growth; Symposium on molecular beam epitaxy, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solution. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

T-14352.

Short note. 1 ref. LEAD TELLURIDES/crystal structure; LEAD TELLURIDES/epitaxy; TIN TELLURIDES/crystal structure; TIN TELLURIDES/epitaxy; CHEMICAL COMPOSITION; ETCHING; EPITAXY; SOLID SOLUTIONS; SUBSTRATES

943 (N–89-19402) **Acidic attack of perfluorinated alkyl ether lubricant molecules by metal oxide surfaces.** Zehe, M.J.; Faut, O.D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 17p. (NASA-TM–101962;E–4660;NAS–1.15:101962;CONF-891036–: Joint American Society of Mechanical Engineers/Society of Tribologists and Lubrication Engineers tribology conference, Ft. Lauderdale, FL (USA), 16-19 Oct 1989). Available from NTIS, PC A03/MF A01.

The reactions of linear perfluoropolyalkylether (PFAE) lubricants with alpha-Fe_2O_3 and Fe_2O_3-based solid superacids were studied. The reaction with alpha-Fe_2O_3 proceeds in two stages. The first stage is an initial slow catalytic decomposition of the fluid. This reaction releases reactive gaseous products which attach the metal oxide and convert it to FeF_3. The second stage is a more rapid decomposition of the fluid, effected by the surface FeF_3. A study of the inital breakdown step was performed using alpha-Fe2O3, alpha-Fe_2O_3 preconverted to FeF_3, and sulfate-promoted alpha-Fe_2O_3 superacids. The results indicate that the breakdown reaction involves acidic attack at fluorine atoms on acetal carbons in the linear PFAE. Possible approaches to combat the problem are outlined.

944 (N–89-26684) **Recent advances in electronic structure theory and their influence on the accuracy of ab initio potential energy surfaces.** Bauschlicher, C.W. Jr.; Langhoff, S.R.; Taylor, P.R. National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center. 1988. 21p. (NASA-CR–182895;NAS–1.26:182895). Available from NTIS, PC A03/MF A01.

Recent advances in electronic structure theory and the availability of high speed vector processors have substantially increased the accuracy of ab initio potential energy surfaces. The recently developed atomic natural orbital approach for basis set contraction has reduced both the basis set incompleteness and superposition errors in molecular calculations. Furthermore, full CI calculations can often be used to calibrate a CASSCF/MRCI approach that quantitatively accounts for the valence correlation energy. These computational

advances also provide a vehicle for systematically improving the calculations and for estimating the residual error in the calculations. Calculations on selected diatomic and triatomic systems will be used to illustrate the accuracy that currently can be achieved for molecular systems. In particular, the F+H2 yields HF+H potential energy hypersurface is used to illustrate the impact of these computational advances on the calculation of potential energy surfaces.

945 (N–89-26685) **On the electron affinities of the Ca, Sc, Ti and Y atoms.** Bauschlicher, C.W. Jr.; Langhoff, S.R.; Taylor, P.R. National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center. 1988. 8p. (NASA-CR–181277;NAS–1.26:181277). Available from NTIS, PC A02/MF A01.

For the Ca, Sc, Ti and Y atoms calculations are performed for the ground states of the neutrals and the ground and several low-lying excited states of the negative ions. Overall the computed electron affinities are in good accord with experiment. The calculations show the rapid stabilization of the 3d orbital relative to the 4p as the nuclear charge increases. The 3F(0) and 3D(0) terms are found to be close in energy in Sc(-) and in Y(-). This confirms earlier speculation that some of the peaks in the photodetachment spectra of Y(-) originate from the bound excited 3F(0) term of Y(-).

946 (N–89-26741) **Development of new techniques for the characterization of crystals and their growth solutions: Center director's discretionary fund. Final report.** Kroes, R.L.; Reiss, D.A. National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center. Jun 1989. 21p. (NASA-TM–100371;NAS–1.15:100371). Available from NTIS, PC A03/MF A01.

The solubility measurement system and the laser scattering microscope system were designed, built, and utilized for the study of crystal growth solutions and crystal characterization measurements. Solubility measurements and crystal defect maps were made with this equipment for a number of new materials. In some cases, where there have been published solubility data (i.e., TGS), more accurate measurements were made and discrepancies in the published data were resolved. The design of these instruments is presented along with a description of their use and some typical data generated using them.

947 (UCRL–101908) **Shock compression studies of condensed matter.** Ross, M. Lawrence Livermore National Lab., CA (USA). Aug 1989. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907152–1: Short course on high-pressure equations of state: theory and applications, Varenna (Italy), 25 Jul - 4 aug 1989). Order Number DE90001058. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present article summarizes several topics covered during the lectures which are tied together mainly in that they illustrate the usefulness of shock compression studies combined with diamond-anvil measurements and theoretical analysis to understand the properties of condensed matter at high compression. McQueen and Fortov in their contributions to this volume, have reviewed the principles of shock compression and included many examples. In Section 2 we review, how the high temperatures generated by the shock process in liquids makes this technique particularly valuable for determining the interatomic short range repulsive potential (argon), studying the dissociation of molecules (nitrogen) and metals (aluminum). The interesting connection between rare gases and metals provided by d-electrons is illustrated in Section 3, by the close relationship of cesium, xenon and metallic iodine. An important unifying concept, reviewed in Section 4, is the relationship of d-state occupancy to structural stability. 51 refs., 20 figs.

948 **Molal dissociation quotients of water in sodium trifluoromethanesulfonate solutions to high temperatures.** Palmer, D.A. (Oak Ridge National Lab., TN (USA)); Drummond, S.E. *Journal of Solution Chemistry (USA),* 17(2): 153-164 (Feb 1988). DOE Contract AC05-84OR21400.

The molal dissociation quotients and corresponding thermodynamic quantities for water were determined from potentiometric measurements at 25°C intervals from 25 to 250°C in the presence of sodium trifluoromethanesulfonate at six molalities ranging from 0.2 to 6.5. These quantities are compared with published results for the dissociation of water in sodium chloride solutions and an estimate is made of the ion-pair association quotient for HCl.

949 **A simplified representation for the thermal conductivity of fluids in the critical region.** Olchowy, G.A. (Univ. of Maryland, College Park (USA)); Sengers, J.V. *International Journal of Thermophysics (USA),* 10(2): 417-426 (Mar 1989). DOE Contract FG05-88ER13902. (CONF-880606–: 10. symposium on thermophysical properties, Gaithersburg, MD (USA), 20-23 Jun 1988).

A practical representation for the critical thermal conductivity enhancement is developed by incorporating a finite cutoff into the asymptotic mode-coupling integrals for the diffusivity associated with the critical fluctuations. This procedure yields a simplified approximation to a more complete nonasymptotic solution of the mode-coupling integrals obtained by them earlier. A comparison is made with thermal conductivity data for carbon dioxide, ethane, and methane.

950 **Vapor pressures and gas-phase PVT data for 1,1,1,2-tetrafluoroethane.** Weber, L.A. (National Institute of Standards and Technology, Gaithersburg, MD (USA)). *International Journal of Thermophysics (USA),* 10(3): 617-627 (May 1989). (CONF-880606–: 10. symposium on thermophysical properties, Gaithersburg, MD (USA), 20-23 Jun 1988).

The authors present new data for the vapor pressure and PVT surface of 1,1,1,2-tetrafluoroethane (Refrigerant 134a) in the temperature range 40°C (313 K) to 150°C (423 K). The PVT data are for the gas phase at densities up to one-half critical. Densities of the saturated vapor are derived at five temperatures from the intersections of the experimental isochores with the vapor pressure curve. The data are represented analytically in order to demonstrate experimental precision and to facilitate calculation of thermodynamic properties.

951 **The interaction of oxygen molecules with amorphous Ge, Ge:H, and some Ge:C:H alloys.** Shinar, R. (Microelectronics Research Center, Iowa State University, Ames, Iowa 50011 (US)); Entringer, A.G.; Shinar, J.; Wu, H.; Shanks, H.R. *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films (USA),* 7(5): 2998-3004 (Sep 1989).

The interaction of oxygen molecules with Ar^+ sputter-etched (amorphized) Ge(100) and rf sputter-deposited amorphous germanium carbides (a-$Ge_{1-x}C_x$:H), $0 \leq x \leq 0.5$, was investigated using Auger measurements and core-level, valence-band, and high-resolution electron energy-loss spectroscopies (EELS). A film covered with native oxide was also studied. Samples were exposed to oxygen following surface cleaning by Ar^+ etching. This procedure, as previously reported, preferentially removed hydrogen bonded to Ge in a-Ge:H and a-$Ge_{1-x}C_x$:H films. High-resolution EELS indicated dissociative chemisorption of oxygen on Ge in all Ar^+-etched samples used in this study. The oxygen appears to be bonded to Ge mainly in an isolated bridge form (+1 oxidation state) at the early stages of oxidation. Even when the surface was pre-exposed to 10^4-L O_2, subsequent exposure to hydrogen atoms indicated the existence of a high density of bonds available for hydrogen bonding, contrary to observations at Ge(111). Under these conditions the Ge–H stretch loss split into two features separated by ~8 meV. Possible bonding configurations, including oxygen bridging between the first and second layers, are discussed. Valence-band EEL spectra exhibited a single oxygen induced loss at an energy loss similar to that observed for single crystals of Ge. Core-level shifts due to oxidation were not observed as was the case for room-temperature adsorption on single crystals. In addition, no change in the Ge(MVV) Auger line shape was induced by oxygen chemisorption, in contrast to previously observed hydrogen related changes. These results are compared to those reported for single crystals of Ge.

952 **Reaction rates of H(H_2), D(H_2), and H(D_2) van der Waals molecules and the threshold behavior of the bimolecular gas-phase rate coefficient.** Hancock, G.C. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455 (US)); Mead, C.A.; Truhlar, D.G.; Varandas, A.J.C. *Journal of Chemical Physics (USA),* 91(6): 3492-3503 (15 Sep 1989).

We study low-energy quantal phenomena in the rearrangement of three-atom systems composed of H and D. All calculations are carried out on the double many-body expansion potential energy

surface for the hydrogen trimer. The unimolecular rearrangements of van der Waals molecules, such as $D\cdots H_2 \rightarrow HD\cdots H$, are studied as a model for the exchange transfer reaction in condensed phases, and the gas-phase bimolecular reactions, such as $D+H_2 \rightarrow HD+H$, are studied to probe the limiting low-temperature threshold behavior, which is compared to that predicted by quantum mechanical threshold laws. The reaction rates are studied down to temperatures of 10^{-3} K. We also predict the spectroscopic tunneling shift on the lowest energy levels of the $H\cdots H_2$ complex.

953 **Cooperative adsorption-desorption models with random steady states.** Evans, J.W. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)); Hurst, C.A. *Physical Review [Section] A: General Physics (USA),* 40(6): 3461-3463 (15 Sep 1989). DOE Contract W-7405-ENG-82.

We analyze some nontrivial cooperative adsorption-desorption models that exhibit trivial random steady states. The subtle balance in dynamical processes maintaining these steady states is elucidated. In addition, we analyze the complicated kinetics of the approach to the steady state.

954 **Block Lanczos approach combined with matrix continued fraction for the *S*-matrix Kohn variational principle in quantum scattering.** Yang, W. (Department of Chemistry, University of California, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 (US)); Miller, W.H. *Journal of Chemical Physics (USA),* 91(6): 3504-3508 (15 Sep 1989).

An iterative method is proposed for calculating the *S* matrix in the Kohn variational approach. Instead of solving the system of linear equations directly, the method consists of a block Lanczos algorithm extended to complex symmetric matrices and a matrix continued fraction procedure. Applications to inelastic and reactive scattering calculations indicate a reasonable rate of convergence.

955 **Chemical association in simple models of molecular and ionic fluids.** Stell, G. (Departments of Chemistry and Mechanical Engineering, State University of New York at Stony Brook, Stony Brook, New York 11794 (US)); Zhou, Y. *Journal of Chemical Physics (USA),* 91(6): 3618-3623 (15 Sep 1989).

A simple approximation scheme is given for the association constant of a family of models of associating particles introduced and considered by Cummings and Stell, Rasaiah *et al.*, and Stell. The result correctly reduces to the law of mass action at low concentrations. For the ionic-species version, the theory requires accurate assessment of the cavity function of charged hard spheres, for which we develop a recipe. We show the close similarity (and some differences) between the above models and those considered by Wertheim, through a simple extensions of his models. We also note the equivalence of our approximation and Wertheim's first-order thermodynamic perturbation theory.

956 **Interactions between two identical polymer chains studied with first-principles calculations.** Springborg, M. (Nordisk Institut for Teoretisk Atomfysik (NORDITA), Blegdamsvej 17, DK-2100 Kobenhavn O, Denmark (DK)). *Physical Review [Section] B: Condensed Matter (USA),* 40(8): 5774-5779 (15 Sep 1989).

Results of parameter-free calculations on the interactions between two otherwise isolated, infinite, linear, polymeric chains are reported and discussed. The systems considered are (i) two hydrogen fluoride chains (as an example of a hydrogen-bonded polymer) and (ii) two carbon chains (as an example of a conjugated polymer). It is demonstrated that the interactions are larger than usually assumed for such systems. As a consequence of the results it is suggested that a soliton initially confined to a single chain will lead to distortions of neighboring chains and thus become a three-dimensional defect.

4004 Electrochemistry

Refer also to citation(s) 555, 901, 948

4005 Photochemistry

Refer also to citation(s) 906

957 **Hole and antihole profiles in nonphotochemical hole-burned spectra.** Lee, I. (Ames Laboratory,U. S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011 (US)); Hayes, J.M.; Small, G.J. *Journal of Chemical Physics (USA),* 91(6): 3463-3469 (15 Sep 1989).

The shapes of the real-phonon and pseudophonon sideband holes (PSBH) which occur in hole-burned spectra in amorphous solids are both wavelength and burn time dependent. The theory previously proposed to simulate hole shapes in the short burn time limit is extended to examine the PSBH shapes at arbitrary times and at different burn wavelengths. The simulated spectra are compared with experimental data for tetraphenyl porphin in polystyrene. It is also shown how the simulated spectra may be used to deconvolve the antihole spectrum from the hole spectrum.

4006 Radiation Chemistry

Refer also to citation(s) 1419, 1834

4007 Radiochemistry and Nuclear Chemistry

958 (CONF-891119–2) **Identification of secondary phases formed during unsaturated reaction of UO_2 with EJ-13 water.** Bates, J.K.; Tani, B.S.; Veleckis, E. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90001908. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A set of experiments, wherein UO_2 has been contacted by dripping water, has been conducted over a period of 182.5 weeks. The experiments are being conducted to develop procedures to study spent fuel reaction under unsaturated conditions that are expected to exist over the lifetime of the proposed Yucca Mountain repository site. One half of the experiments have been terminated, while one half are ongoing. Analyses of solutions that have dripped from the reacted UO_2 have been performed for all experiments, while the reacted UO_2 surfaces have been examined for the terminated experiments. A pulse of uranium release from the UO_2 solid, combined with the formation of schoepite on the surface of the UO_2, was observed between 39 and 96 weeks of reaction. Thereafter, the uranium release decreased and a second set of secondary phases was observed. The latter phases incorporated cations from the EJ-13 water and included boltwoodite, uranophane, sklodowskite, compreignacite, and schoepite. The experiments are continuing to monitor whether additional changes in solution chemistry or secondary phase formation occurs. 6 refs., 2 figs., 2 tabs.

959 (DOE/FTR–90002426) **[The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989.** Srivastava, S.C. Brookhaven National Lab., Upton, NY (USA). 12 Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002426. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Third International Symposium on "Technetium in Chemistry and Nuclear Medicine was held in Montegrotto Terme (Padova), Italy, during September 6-8, 1989. The aim of the symposium was to review and update the knowledge on technetium and rhenium chemistry related to their use as radiopharmaceuticals in nuclear medicine research and clinical practice. All relevant topics in these areas were covered. The meeting included seven plenary lectures, 13 invited lectures, 42 contributed oral presentations, and 51 poster presentations. A total of about 180 registered participants representing 25 countries attended the meeting. A total of 12 sessions were spread over 3 days, five out of these were set aside for poster viewing and discussions. Oral and poster contributions consisted of original research data on specific topics in the area of technetium and rhenium chemistry, radiopharmaceutical synthesis, and clinical applications.

960 (INIS-BR–1645) **Separation of ^{99}Mo from ^{132}Te using thiourea as complexing agent. Application to the separation of ^{99}Mo from the fission products.** Mestnik, S.A.C.; Silva, C.P.G. da. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil).

[1989]. 1p. Order Number DE90606221. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. MOLYBDENUM 99/fission products; MOLYBDENUM 99/isotope separation; GAMMA SPECTROSCOPY; RESINS; TELLURIUM 132; THIOUREA; URANIUM 235; RADIOISOTOPE GENERATORS

961 (INIS-mf–11544) **Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.** Mitta, A.E.A.; Canellas, C.O.; Caro, R.A. (eds.). Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. 212p. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Individual items in scope for the data base are processed separately. (DLC)

962 (INIS-mf–11544, pp. 75-84) **Simple method for the preparation of difficult ^{99m}Tc complexes using surface adsorbed stannous ions.** Maddalena, D.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights (Australia). Isotope Div.); Snowdon, G.M.; Awaluddin, A.; Pojer, P.M. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A simple new technique where stannous tin is adsorbed on the inner surface of plastic tubing and used to reduce (^{99m}Tc) pertechnetate prior to labelling radiopharmaceuticals, has been evaluated, using some lipophillic and metal containing ligands. Complexes formed using the technique had good labelling efficiency and behaved the same in rat biodistribution studies as those prepared using conventional labelling methods. The labelling efficiency of the ligands was not related to their lipophillicity suggesting that this technique may be useful for labelling lipophillic and other difficult ligands such as those containing metals, which are incompatible with free stannous ions in solution. (M.E.L.).

963 (INIS-mf–11544, pp. 107-128) **Synthesis and properties of 1-(4-iodo-5nitroimidazolyl)-2-hydroxy-3 methoxypropane. A novel radiosensitizer for use as an hypoxic cell marker.** Wiebe, L.I. (Alberta Univ., Edmonton, AB (Canada)); Jette, D.C.; Mercer, J.R.; Samuel, B.; Flanagan, R.J.; Lee, J.; Meeker, B.E.; Chapman, J.D. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacologoy held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

1-(4-iodo-5- nitroimdazolyl) 2-hidroxy-3-methoxypropane (NHMP) has been synthesized and radiolabelled with ^{131}I for use as an in vivo marker of tumor hypoxia.4-I-5-NHMP was found to be a potent radiosensitizer of hypoxic EMT-6 cells in culture, being 5-10 times more potent than misonidazole (MISO). The oxygen enhancement ratio (O.E.R.) for these cells t 10% survival was 2,85. Cytotoxicity studies with cultured EMT-6 cells produced 50 % growth inhibition at 0.07 mM, a toxicity about 50 greater than MISO toxicity under identical conditions. However, studies of the uptake of ^{131}I-labelled 4-I-5-NHMP in both aerobic and hypoxic EMT-6 cells showed no metabolic dependent or hypoxia-specific uptake of the radiolabel. High pressure liquid chromatographic (HPLC) examination of the cultured medium indicated that rapid metabolic deiodination took place in both oxygenated and hypoxic cell cultures, and that nitroreduction occurred under hypoxic conditions. These data suggested that a deiodinated metabolite of 4-I-5-NHMP, rather than the parent compound, is the radiosensitizing species. In scintigraphic studies, uptake of radioiodide by the thyroid was consistent with rapid in vivo deiodination after i.v. injection of 4-^{131}I-5-NHMP into a normal Sprague-Dawley rat or into mice bearing sub-cutaneous implanted Lewis lung carcinomas. (Author).

964 (INIS-mf–11544, pp. 184-187) **Preparation and quality control of ^{186}Re compounds.** Noto, M.G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Amor, R.A.; Caviglia, D.A.; Ratner, M.T.; Schroder, A.M.; Rocco, J.C.; Mancini, A.C. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (In Spanish). (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The optimal conditions were investigated in order to label the methylendiphosphonate (MDP), hydroxyethylendiphosphonate (HEDP), pyrophosphonate (PYP) and ethylendiaminotetramethylenphosphoric (EDTMP) with ^{186}Re. The biodistribution of these compounds in experimental animals were studied to determine the most suitable therapeutic agent for its eventual use as pain palliative in patients with bone metastases. The biodistribution assays were performed in Wistar rats, and the ^{186}Re HEDP was finally chosen. (M.E.L.).

965 (INIS-mf–11544, pp. 188-201) **Diisopropylida,Mebrophenyn,Iodophenyn labelled with ^{99m}Tc. Its evaluation in several biological models.** Arguelles, M.G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Canellas, C.O.; Mitta, A.E.A.; Leon, A.S.; Verdera, E.S.; Leon, E. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (In Spanish). (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A study is presented on the following compounds: N-(2,6 diisopropylphenyl-carbomoylmethyl iminodiacetic) acid (DIISIDA), N-(3-iodine -2,4,6 trimethylphenylcarbamoylmethyl) iminodiacetic acid (IODOPHENIN), and the N(3-Br-2,4,6 trimethylphenylcarbamoyl) iminodiacetic acid (MEBROPHENIN) used in investigations of hepatobiliary problems. These compounds were labelled in the following way: 20.10^{-6} Kg of N compound, 2.10^{-7}Kg of $SnCl_2H_2O$ at N atmosphere in 1 ml volume. 20mCi of Na(99mTc) pertechnetate solution to the solution was added. The biodistribution was studied in mice which were given. 1.10^{-4}l of chelate, while the urinary elimination was studied in dogs. When the gallbladder behaviour was examined the DIISIDA was found to have a slower transit than the halogen compounds, to greatest activity happened 15 min later. In respect of the urinary elimination, the halogen compounds show much less excretion than the DIISIDA: the obtained results in both biological models were the same. (M.E.L.).

966 (INIS-mf–11544, pp. 202-206) **Preparation and quality control of fibrinogen ^{99m}Tc.** Noto, M.G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Rabiller, Graciela; Garrie Faget, Claudio; Fisman, Carlos; Manzini, Alberto. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (In Spanish). (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A method of fibrinogen preparation is presented in order to label it with ^{99m}Tc employing Sn as reducing agent in alkaline medium. Purity controls by chromatography, coagulation in rabbits and biodistribution in rats were performed. It is concluded that optimal time incubation is between 22 and 23 hs. (M.E.L.).

967 (WSRC-RP–89-77) **Foam and gel decontamination techniques.** McGlynn, J.F.; Rankin, W.N. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-890488–11-Vugraphs: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 23-27 Apr 1989). Order Number DE90001379. Available from NTIS, PC A03/MF A01 - OSTI.

The Savannah River Site is investigating decontamination technology to improve current decontamination techniques, and thereby

reduce radiation exposure to plant personnel, reduce uptake of radioactive material, and improve safety during decontamination and decommissioning activities. When decontamination chemicals are applied as foam and gels, the contact time and cleaning ability of the chemical increases. Foam and gel applicators apply foam or gel that adheres to the surface being decontaminated for periods ranging from fifteen minutes (foam) to infinite contact (gel). This equipment was started up in a cold environment. The desired foam and gel consistency was achieved, operators were trained in its proper maintenance and operation, and the foam and gel were applied to walls, ceilings, and hard to reach surfaces. 17 figs.

968 (ZfK–584, pp. 115) **Determination of the areal density of the Pu-239 fission-foils.** Merla, K. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Herbach, C.M.; Perez, R.; Kostochkin, O.I.; Solovjev, S.M. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. PLUTONIUM 239 TARGET/alpha spectra; PLUTONIUM 239 TARGET/density; ACCURACY; APERTURES; CORRECTIONS; EXTRAPOLATION; FISSILE MATERIALS; FOILS; GEOMETRY; DENSITY

969 (ZfK–584, pp. 116) **Determination of the inhomogeneity of U-238 fission-foils by Rutherford-backscattering (RBS) measurements.** Merla, K. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Groetzschel, R. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. URANIUM 238 TARGET/mass distribution; URANIUM 238 TARGET/rutherford scattering; FISSION FOIL DETECTORS; ACCURACY; ALPHA PARTICLES; BACKSCATTERING; CROSS SECTIONS; DENSITY; FISSILE MATERIALS; FOILS; LEVEL WIDTHS; SPECIFICATIONS; SPECTRA; THICKNESS

970 (ZfK–584, pp. 108) **Variant for on-line rapid extraction in nuclear-chemical experiments with crown ethers.** Langrock, E.J. (Technische Hochschule, Leipzig (German Democratic Republic)); Eichhorn, K.; Gloe, K.; Muehl, P. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. NUCLEAR CHEMISTRY/on-line systems; NUCLEAR CHEMISTRY/solvent extraction; ALPHA REACTIONS; AQUEOUS SOLUTIONS; ETHERS; LEAD 197; LEAD 199; LEAD 202; LEAD 204; MERCURY ISOTOPES; ORGANIC SOLVENTS; PHASE STUDIES; TARGET CHAMBERS; TARGETS; TIME DEPENDENCE

4008 Combustion, Pyrolysis, and High-temperature Chemistry

971 (AGARD-CP–437-VOL-2, pp. 17) **Accuracy and efficiency of a time marching approach for combustor modeling.** Boretti, A.A.; Martelli, F.G. Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). Dec 1988. (CONF-880532–: American Nuclear Society topical meeting, Seattle, WA (USA), 1-5 May 1988). In *Validation of Computational Fluid Dynamics. Volume 2: Poster papers.* Available from NTIS, PC A11/MF A01.

Research on numerical modeling of turbulent reactive gas flows is being conducted at the University of Florence Department of Energy Engineering (DEF) to provide improved analytical models of combustion devices. The objective is to develop adequate mathematical models of physical processes and a solution algorithm with suitable numerical properties. Both the flow model and the numerical method adopted are described in detail.

972 (DOE/ER/13427–2) **Simultaneous multipoint measurements of density gradients and temperature in a flame: Final report, August 1, 1985–July 31, 1987.** Long, M.B. Yale Univ., New Haven, CT (USA). Dept. of Mechanical Engineering. Sep 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13427. Order Number DE90001719. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A summary is given of research directed toward the study of turbulent reacting and nonreacting flows by nonintrusive in situ optical techniques. During the funding period, new diagnostic techniques were developed for the instantaneous mapping of species concentration and temperature in turbulent flames in two and three dimensions. A number of different light scattering mechanisms were utilized including Rayleigh scattering, spontaneous Raman scattering, and fluorescence. Simultaneous measurements of multiple scalars were demonstrated and a method for determining all three components of the scalar gradient was developed. Using advances in high-speed imaging systems, two-dimensional measurements of gas-phase flows were performed at rates high enough to follow their temporal evolution. The data provided by these techniques will be useful for understanding the interaction of turbulence and chemistry in turbulent flames. 18 refs.

973 (N–89-18526) **SRB combustion dynamics analysis computer program (CDA-2). Final report.** Chung, T.J.; Park, O.Y. Alabama Univ., Huntsville, AL (USA). Jan 1989. 156p. (NASA-CR–184663;NAS–1.26:184663). Available from NTIS, PC A08/MF A01.

Two-dimensional combustion dynamics of solid propellants numerically modeled by finite element calculations and applied to a one-dimensional cast for comparison is examined. A multidimensional numerical model was developed for the unsteady state oscillatory combustion of solid propellants subject to acoustic pressure disturbances. Including the gas-phase effects, the assumption of uniform pressure across the flame zone, which was conventionally used, is relaxed such that a higher frequency response in the long flame of a double-base propellant can be calculated. The formulation is based on a premixed, laminar flame with a one-step overall chemical reaction and the Arrhenius law of decomposition with no condensed phase reaction. In a given geometry, the Galerkin finite element solution shows the strong resonance and damping effect at the lower frequencies. Extended studies deal with the higher frequency region where the pressure varies in the flame thickness. The nonlinear system behavior is investigated by carrying out the second order expansion in wave amplitude when the acoustic pressure oscillations are finite in amplitude. Offset in the burning rate shows a negative sign in the whole frequency region considered, as confirmed by existing experimental results. Finally, the velocity coupling in the two-dimensional model is discussed in terms of higher order perturbations.

974 (N–89-19446) **Solid surface combustion space shuttle experiment hardware description and ground-based test results.** Vento, D.M.; Zavesky, R.J.; Sacksteder, K.R.; Altenkirch, R.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jan 1989. 9p. (NASA-TM–101963;E–4661;NAS–1.15:101963;CONF-890123–: 27. AIAA aerospace sciences meeting, Reno, NV (USA), 9-12 Jan 1989). Available from NTIS, PC A02/MF A01.

The Lewis Research Center is developing a series of microgravity combustion experiments for the Space Shuttle. The Solid Surface Combustion Experiment (SSCE) is the first to be completed. SSCE will study flame spreading over thermally thin fuels (ashless filter paper) under microgravity conditions. The flight hardware consists of a combustion chamber containing the sample and a computer which takes the data and controls the experiment. Experimental

data will include gas-phase and solid-phase temperature measurements and motion pictures of the combustion process. Flame spread rates will be determined from the motion pictures.

975 (N–89-20218) **Modeling of hydrogen-air diffusion flame. Interim report.** Isaac, K.M. Missouri Univ., Rolla, MO (USA). Mar 1989. 16p. (NASA-CR–184844;NAS–1.26:184844). Available from NTIS, PC A03/MF A01.

An analytical and computational study of opposed jet diffusion flame for the purpose of understanding the effects of contaminants in the reactants and thermal diffusion of light species on extinction and reignition of diffusion flames is in progress. The methodologies that have been attempted so far are described. Results using a simple, one-step reaction for the hydrogen-air counterflow diffusion flame are presented. These results show the correct trends in the profiles of chemical species and temperature. The extinction limit can be clearly seen in the plot of temperature vs. Damkohler number.

976 (N–89-22817, pp. 99-106) **Direct simulation of compressible reacting flows.** Poinsot, T.J. Stanford Univ., CA (USA). Feb 1989. (NASA-CR–184906;NAS–1.26:184906). In *Annual research briefs, 1988.* Available from NTIS, PC A08/MF A01.

A research program for direct numerical simulations of compressible reacting flows is described. Two main research subjects are proposed: the effect of pressure waves on turbulent combustion and the use of direct simulation methods to validate flamelet models for turbulent combustion. The interest of a compressible code to study turbulent combustion is emphasized through examples of reacting shear layer and combustion instabilities studies. The choice of experimental data to compare with direct simulation results is discussed. A tentative program is given and the computation cases to use are described as well as the code validation runs.

977 (NAL-TR–960) **Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method.** Gomi, Hiromi. National Aerospace Lab., Chofu, Tokyo (Japan). Feb 1988. 57p. (In Japanese). Order Number DE89900737. Available from NTIS (US Sales Only), PC A04/MF A01.

As a part of study to understand and measure quantitatively the combustion process of liquid fuel, a numerical experiment of the multiply scattering of light and an inversion to find out the particle diameter distribution were executed in order to simulate the influence of the multiple scattering of light in the particle diameter measurement by a ray tracing method. In the numerical experiment of the multiple scattering of light, only the forward scattering light by the light propagation was taken into consideration, and an algebraic equation was set up from the geometrical optic conditions on the assumption of one-dimensional axial symmetry. This method is approximate to the Flux method and the Discrete Ordinates method in the existing theories of multi scattering. To execute the numerical experiment within feasible time, the interference effect of light was neglected and the globular particles and the surrounding medium were supposed to be optically isotropic. As a result of the numerical experiment, the number of splitting plates coincided with the theoretical transmittance. As for the measurement of equivalent thickness of water in the spray of water and air, the value measured by a ray tracing method increased with the correction by multiple scattering, and came nearer to the value measured by a x-ray attenuation method. 45 refs., 23 figs., 5 tabs.

978 **Laser-induced fluorescence determination of temperatures in low pressure flames.** Rensberger, K.J. (SRI International, 333 Ravenswood Avenue, Menlo Park, California 94025 (US)); Jeffries, J.B.; Copeland, R.A.; Kohse-Houinghaus, K.; Wise, M.L.; Crosley, D.R. *Applied Optics (USA),* 28(17): 3556-3566 (1 Sep 1989).

Spatially resolved temperatures in a variety of low pressure flames of hydrogen and hydrocarbons burning with oxygen and nitrous oxide are determined from OH, NH, CH, and CN laser-induced fluorescence rotational excitation spectra. Systematic errors arising from spectral bias, time delay, and temporal sampling gate of the fluorescence detector are considered. In addition, we evaluate the errors arising from the influences of the optical depth and the rotational level dependence of the fluorescence quantum yield for each radical. These systematic errors cannot be determined through goodness-of-fit criteria and they are much larger than the statistical precision of the measurement. The severity of these problems is different for each radical; careful attention to the experimental design details for each species is necessary to obtain accurate LIF temperature measurements.

42 ENGINEERING

4202 Facilities and Equipment

Refer also to citation(s) 115, 128, 129, 130, 131, 132, 145, 160, 168, 211, 304, 759, 776, 1051, 1130, 1726, 1982, 1985, 1991

979 (AD-A–209108/0/XAB) **Design assessment for metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic composite overwind.** Groves, A.; Margetson, J. Royal Armament Research and Development Establishment, Westcott (UK). Mar 1989. 29p. (RARDE–12/88). Available from NTIS, PC A03/MF A01.

A design assessment is presented for thick-walled metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic fiber-reinforced composite overwind. The assessment is restricted to the most important study of evaluating, for five potential composite overwinds, the relationship between the reinforcement thickness and metallic liner thickness to yield a vessel of comparable strength to an all-metal reference vessel. The resulting data are nevertheless used in a series of ancillary analyses, namely weight comparisons, strain to failure studies and detailed stress computations, to establish optimum configurations and, moreover, to identify the most suitable overwinding material. The influence of variations in the considerably lower transverse moduli (radial and axial) of the circumferentially reinforcing material is also considered by repeating the assessment studies for both 10GPa and IGPa transverse moduli composite overwinds.

980 (AD-A–209875/4/XAB) **Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989.** Iannello, V.; Marshall, J.S.; Stacy, W.D. Creare, Inc., Hanover, NH (USA). May 1989. 52p. (CREARE-TM–1352). Available from NTIS, PC A04/MF A01.

State-of-the-art miniature expansion turbines and centrifugal compressors used in spaceborne sensor cryocoolers employ self-acting gas bearings to achieve high reliability and long operating life. Because these bearings must run at room temperature to achieve adequate stiffness and stability, they result in an avoidable source of heat leak to the process gas, thereby lowering overall cycle efficiency and increasing the system launch weight. This report shows that the gas bearings can be replaced by Meissner-effect bearings fabricated from high-temperature superconducting materials. Analyses are presented to predict Meissner bearing performance, and a preliminary design of a miniature expansion incorporating Meissner-bearings is conceptualized. Because these bearings operate at a cryogenic temperatures, a substantial reduction in heat leak to the process gas can be achieved. For a typical cryocooler providing 1 watt of cooling at 10 K, a 40% reduction in input-cycle power can be achieved by replacing the self-acting gas bearings by Meissner bearings in the cold expansion turbine.

981 (AD-A–209951/3/XAB) **Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988.** Oliger, J. Stanford Univ., CA (USA). Dept. of Computer Science. Jun 1989. 5p. Available from NTIS, PC A02/MF A01.

The major objective in the work funded under this contract was to continue work begun under the ONR contract N0014-82-K-0335 related to adaptive grid methods for engineering problems in fluid dynamics and the development of parallel algorithms for the same class of problems. Subjects treated include: Adaptive numerical methods for incompressible flow; Composite grid generation; Software systems for scientific computation; and Algorithm development for parallel computation.

982 (AD-A-209960/4/XAB) **Wide-band superconductive Chirp filters.** Dilorio, M.S.; Withers, R.S.; Anderson, A.C. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. Apr 1989. 7p. (JA-6082). Available from NTIS, PC A02/MF A01.

Pub. in IEEE Transactions on Microwave Theory and Techniques, Vol. 47, No. 4, 706-710(Apr 1989).

Chirp filters are described that consist of miniature tapped superconductive stripline. The stripline consists of 40-micron-wide niobium thin films in a spiral pattern on 125-micron-thick silicon wafers, and tapping is effected by backward-wave couplers between neighboring lines. Sophisticated fabrication and packaging techniques have led to a now mature technology. Devices with 2.6-GHz bandwidth and time-bandwidth products of 98 are routinely fabricated that exhibit amplitude errors within a few tenths of a decibel and phase errors within a fractions of a degree of theoretical. In pulse-compression tests, matched amplitude-weighted devices yield peak relative side-lobe levels of -32 dB.

983 (AD-A-209965/3/XAB) **Superconducting stripline resonators and high-T_c materials.** Oates, D.E.; Anderson, A.C.; Shis, B.S. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 1989. 5p. (MS-8260). Available from NTIS, PC A02/MF A01.

Pub. in IEEE MTT-S Digest, 627-630(1989).

The use of high-transition-temperature (Tc) superconducting resonators to stabilize oscillators operating between 1 and 10 GHz is discussed. Measurements of surface resistance are presented and related to resonator quality factor (Q). Projections of resonator Q and oscillator phase noise are discussed. Improved materials should offer greater than 20 dB reduction in noise over competing technology. The implications of flicker noise in reaching this level of performance are discussed, and preliminary measurements of flicker noise in the high-Tc materials are reported.

984 (AD-A-210075/8/XAB) **Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989.** Dingus, M.L. Alabama Cryogenic Engineering, Inc., Huntsville, AL (USA). 23 Jun 1989. 4p. Available from NTIS, PC A02/MF A01.

This document deals with the materials ordered to be used in the construction of a 'cryocooler'. Stainless steel spacers were ordered. Calculations indicated a better design for a heat exchanger using stainless steel spacers and copper plates rather than the niobium plates and glass ceramic spacers.

985 (AGARD-CP-449, pp. 10) **Cryogenic turbopump bearing materials.** Bhat, B.N. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192-: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

Materials used for modern cryogenic turbopump bearings must withstand extreme conditions of loads and speeds under marginal lubrication. Naturally, these extreme conditions tend to limit the bearing life. It is possible to significantly improve the life of these bearings, however, by improving the fatigue and wear resistance of bearing alloys, and improving the strength, liquid oxygen compatibility and lubricating ability of the bearing cage materials. Improved cooling will also help to keep the bearing temperatures low and hence prolong the bearing life.

986 (CONF-891118-3) **Demonstration of criticality safety for the modified TN-REG and TN-BRP transport/storage casks.** Parks, C.V.; Fox, P.B. Oak Ridge National Lab., TN (USA). 1989. 17p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From International meeting on nuclear criticality safety margins; San Francisco, CA (USA); 26 Nov - 1 dec 1989. Order Number DE89015894. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An inability to model the structural performance of borated steel baskets under accident conditions forced the specially designed TN-BRP and TN-REG casks to be modified for half-loaded shipments. This paper discusses the approach used to demonstrate that the half-loaded casks would remain safely subcritical even if no credit were taken for the borated basket. Normal and accident configurations were analyzed with the KENO V.a code. The strategy conceived and the analyses performed to demonstrate an acceptable margin of safety are discussed. 5 refs., 3 figs., 2 tabs.

987 (EGG-M-89303) **Status of spent fuel shipping cask development.** Hall, I.K.; Hinschberger, S.T. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 4p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC07-76ID01570. (CONF-891103-39: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90002024. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The purpose of the Cask Systems Development Program (CSDP) is to develop a variety of cask system which can safely and economically transport commercial spent fuel and high-level waste from the generating sites to a Federal geologic repository or Monitored Retrievable Storage (MRS) facility. This paper is limited to a discussion of the status of from-reactor spent fuel cask development; future cask development plans include MRS-to-repository casks, specialty casks for nonstandard spent fuel and nonfuel materials, and defense high-level waste casks.

988 (N-89-20248) **Experiments with metallic and ceramic porous media. Report 30 December 1988.** Frederking, T.H.K.; Abbassi, P.; Khandhar, P.K.; Luna, J. California Univ., Los Angeles, CA (USA). Dec 1988. 62p. (NASA-CR-184819;NAS-1.26:184819;UCLA-ENG-8838). Available from NTIS, PC A04/MF A01.

Work in the area of mechano-caloric phenomena was initiated during 1988 with startup in the Summer 1988 period. The ideal system utilizing He-II super-phenomena is modeled readily, within the frame of thermodynamics energetics, using the concept of an ideal superleak. The real system however uses porous media of non-ideal pore-grain ingredients. The early phase of experimental and related modeling studies is outlined for the time period from Summer 1988 to the end of 1988.

989 (N-89-22891, pp. 161-175) **Rotordynamic coefficients for labyrinth seals calculated by means of a finite difference technique.** Nordmann, R.; Weiser, P. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Feb 1989. (NASA-CP-3026;E-4227;NAS-1.55:3026;CONF-8805321-: Workshop on rotordynamic instability problems in high-performance turbomachinery, College Station, TX (USA), 16-18 May 1988). In *Rotordynamic Instability Problems in High-Performance Turbomachinery, 1988.* Available from NTIS, PC A20/MF A01.

The compressible, turbulent, time dependent and three dimensional flow in a labyrinth seal can be described by the Navier-Stokes equations in conjunction with a turbulence model. Additionally, equations for mass and energy conservation and an equation of state are required. To solve these equations, a perturbation analysis is performed yielding zeroth order equations for centric shaft position and first order equations describing the flow field for small motions around the seal center. For numerical solution a finite difference method is applied to the zeroth and first order equations resulting in leakage and dynamic seal coefficients respectively.

990 (N-89-26044) **COLD-SAT: An orbital cryogenic hydrogen technology experiment.** Schuster, J.R.; Wachter, J.P.; Powers, A.G. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 14p. (NASA-TM-102303;E-4984;NAS-1.15:102303;IAF-89-057;CONF-8910229-: 40. congress of the International Astronautical Federation, Malaga (Spain), 7-13 Oct 1989). Available from NTIS, PC A03/MF A01.

The COLD-SAT spacecraft will perform subcritical liquid hydrogen storage and transfer experiments under low-gravity conditions to provide engineering data for future space transportation missions. Consisting of an experiment module mated to a spacecraft bus, COLD-SAT will be placed in an initial 460 km circular orbit by an Atlas I commercial launch vehicle. After deployment, the three-axis-controlled spacecraft bus will provide electric power, experiment control and data management, communications, and attitude control along with propulsive acceleration levels ranging from 10(-6) to 10(-4)g. These accelerations are an important aspect of some of the

experiments, as it is desired to know the effects that low gravity levels might have on the heat and mass transfer processes involved. The experiment module will contain the three liquid hydrogen tanks, valves, pressurization equipment, and instrumentation. At launch all the hydrogen will be in the largest tank, which has helium-purged MLI and is loaded and topped off by the hydrogen tanking system used for the Centaur upper stage of the Atlas. The two smaller tanks will be utilized in orbit for performing some of the experiments. The experiments are grouped into two classes on the basis of their priority, and include six regarded as enabling technology and nine regarded as enhancing technology.

991 (ORNL/TM–11318) **Inspection of contaminated hot cell ductwork.** Muller, R.C.; Herndon, J.N.; Dagenhart, W.K. Oak Ridge National Lab., TN (USA). Aug 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001360. Available from NTIS, PC A03/MF A01 - OSTI.

Radiation Sterilization, Incorporated (RSI), of Dekalb County, Georgia, has used Cesium-137 radiation sources for sterilization of medical instruments and other commercial items. The cesium is contained in welded stainless steel capsules. One of these capsules has leaked, allowing the cesium to escape and to contaminate the internals of the sterilization cells including the cell ventilation ductwork penetrating the thick concrete cell roof. This ductwork requires decontamination prior to release of the facility to resume sterilization activities. Due to the small size (20-in. x 24-in. cross section) and the long runs embedded in the cell roof, it was determined that remote visual inspection and preliminary radiation mapping of this ductwork was necessary. This report covers the inspection effort and evaluation of the results. 23 figs., 3 tabs.

992 (PB–89-177539/XAB) **Design method for pressure vessels containing randomly flawed welds. Technical report.** Penny, R.K.; Dutkiewicz, A.G. National Physical Research Lab., Pretoria (South Africa). Atmospheric Sciences Div. Feb 1987. 26p. (TR–84). Available from NTIS, PC EE05/MF E05.

North American Continent sales only.

A method for decision making at the early stages of pressure vessel design was made available by considering the likely presence of flaws at welds in conjunction with the use of a standard finite-element routine for stress-analysis Abaqus. Such a method could be useful not only in assessing failure probabilities but also in directing needed limits of quality control. The procedures suggested have only been applied to a limited form of material variation in the elastic regime and clearly need extension to post-yield conditions and then to elevated-temperature regions in order to examine the wider applicability which should be easily possible.

993 (PB–89-216196/XAB) **Integrating bolometers for infrared-detector arrays. Technical report (Final).** Davidson, A.W. Infrared Labs., Inc., Tucson, AZ (USA). 30 Aug 1986. 39p. Available from NTIS, PC A03/MF A01.

The study is an investigation into the feasibility of operating cryogenic semiconductor bolometers in an integrating mode. The operating mode potentially has significantly higher sensitivity than existing designs. A concept for a heat switch utilizing the large difference in thermal conductances between the normal and superconducting states of certain materials is presented. The report reviews the theory of bolometer operation and the use of superconductors as cryogenic thermal switches. An experimental demonstration of the concept is described in the report. The test used a silicon bolometer suspended on metalized glass fibers. The superconductive switch was a vacuum-evaporated Pb film. A variation of a factor of two in the bolometer thermal conductivity was observed.

994 (PB–89-217095/XAB) **Analysis of an R-SQUID noise thermometer. Doctoral thesis.** Seppae, H. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Lab. of Electrical and Automation Engineering. May 1989. 92p. (VTT/PUB–54). Available from NTIS, PC EE05/MF A01.

Errata sheet inserted.

The metrological performances of the R-SQUID intended to be used as a cryogenic thermometer is verified. The R-SQUID consists of the Josephson junction that converts voltage noise from the shunt resistor into frequency fluctuations. Measuring the value of the shunt resistor and the variance of the frequency fluctuations, the temperature of the bath can be determined. Unfortunately, the absolute temperature determination is disturbed by several effects: a rolloff introduced by a post-detection filter, additional noise caused by the rf amplifiers, a mixed noise effect caused by the nonlinearity of the Josephson-junction together with rf noise in the tank circuit, and the limited number of the frequency counts. In addition, the determination of the shunt resistor may cause a systematic error.

995 (PB–89-869796/XAB) **Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 129p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867544.

This bibliography contains citations of selected patents concerning the design and methods employed in the manufacture of superconductive materials and devices. Methods of fabricating composite materials that are stable under high field strength and high current conditions are discussed. Production of materials used in superconductive winding and switching mechanisms is considered. Superconducting wires used in cryogenic systems and methods of cooling superconductor devices are included. (This updated bibliography contains 326 citations, 24 of which are new entries to the previous edition.)

996 (SAND–89-2034C) **Solving the blow-by problem in a two-stage gun.** Barker, L.M.; Wellman, G.W. Sandia National Labs., Albuquerque, NM (USA). Sep 1989. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789;AC04-76DR00789. (CONF-8909229–1: Aeroballistic Range Association meeting, Paris (France), 24-28 Sep 1989). Order Number DE90000842. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Blow-by is a common occurrence in two-stage light gas guns. Although the blow-by is often inconsequential, it can sometimes present a serious problem. Various projectile designs have been tried to prevent blow-by, and a successful design is described. Computer calculations which clarify the dynamic performance of the design are presented, along with a parameter variation study to indicate the sensitivity of the design to certain geometric parameters. 6 refs., 12 figs., 1 tab.

997 (SAND–89-2216C) **Electrical breakdown in vacuum: Working group report.** Anderson, R.; Hatfield, L. Sandia National Labs., Albuquerque, NM (USA). 1989. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906200–3: Large area electron beam diode workshop, Monterey, CA (USA), 7 Jun 1989). Order Number DE90001623. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The working group on electrical breakdown in vacuum was charged with considering all possible mechanisms by which electrical breakdown might occur either through the vacuum or along insulator bushings in large area electron beam emitter assemblies. It was understood that present systems need to be scaled up, by an order of magnitude or more in both beam area and total energy, to meet demands for higher power and larger size machines, and that increases in the e-beam current density and transport efficiency are also sought. A consideration of the consequences of such a scale-up was pertinent to many of the topics listed in the working-group agenda. Our group attempted to address each of these topics. 18 refs.

998 (UCRL–100272) **Further studies of transverse stress effects in Cable-In-Conduit Conductors.** Summers, L.T.; Miller, J.R. Lawrence Livermore National Lab., CA (USA). 14 Aug 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890701–11: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90001517. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The effect of transverse stress on critical current has been examined for Cable-In-Conduit Conductors (CICC's) containing three active superconducting composite strands in cables containing a total of 21 strands. In measurements of this type reported previously,

only soft copper was used for the inactive strands, allowing the possibility that peaking of stresses at strand cross-over points were avoided by deformation of the copper strands during CICC fabrication and testing. In the present experiments, the degree of critical current degradation was measured as a function of applied load for various void fractions for cable patterns using stainless steel wires as the inactive strands. The reduction of critical current, expressed as a function of load divided by the projected area of the core of the superconducting composite strand, was found to be similar to that observed in cables containing copper inactive strands. All the CICC's tested show a higher sensitivity to transverse stress as compared to single wires. At compressive loads of 50 MPa or less, the region of interest to magnet designers, the critical current is, at worse, 79% of the critical current in unloaded samples. The sensitivity to transverse load is a function of CICC void fraction, lower void fractions having less susceptibility to degradation. The results of this investigation indicate that the performance of large magnets employing CICC designs need not be seriously degraded due to transmitted or self-induced Lorentz loads. 10 refs., 3 figs., 1 tab.

999 (UCRL–101399) **The selection and use of VA/VE [Value Analysis/Value Engineering] professionals.** Sperling, R.B. Lawrence Livermore National Lab., CA (USA). 10 Jul 1989. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907153–1: DOE/NV productivity improvement training seminar, Las Vegas, NV (USA), 13-14 Jul 1989). Order Number DE90000190. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

VA/VE Professionals were selected and used by a federally-funded research facility as consultants to perform VE studies of facilities designs. The experiences of the first year, from preparing the request for quotation, interviewing and evaluating candidate firms to selecting projects to be studied, performing the studies and implementing the proposed cost savings are described as lessons learned, to guide new or expanding VA/VE programs.

1000 (WSRC-RP–89-518) **Development and testing program update for remote cell production of Pu 239.** Duarte, D.S.; Hebert, P.S.; Maddux, E.P.; Kyser, E.A.; Purcell, J.A.; Cakanic, P. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891103–33: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90001317. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Production of Pu 239 metal has traditionally been processed in glove box enclosures to protect operating personnel and the environment from the hazards of radiation exposure and contamination. With the advent of more stringent federal regulations aimed at enhancing protection of personnel, the environment and special nuclear materials, Savannah River Site (SRS) is investigating plutonium processing concepts in a totally remote environment using automated work stations with robotic materials transfer and equipment maintenance. 8 figs., 1 tab.

1001 (Y/DX–878) **A study of the effect of temperature on the measurement of a hemishell by the development coordinate measuring machine.** Hebble, T.L.; Rasnick, W.H. Oak Ridge Y-12 Plant, TN (USA). 25 Sep 1989. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OS21400. Order Number DE90002066. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Significant effects of temperature on deviations from a nominal contour profile circle were found in a study at the Oak Ridge Y-12 Plant of monitor part measurements using the Development coordinate measuring machine (CMM). The mean deviation and TIR of the deviations were determined for each of three latitudes on both the inner and outer surfaces of the hemishell part. A total of 25 runs were made. The magnitude of the important effects ranged from 0.65 μm/°C (14 μin./°F) to 1.2 μm/°C (26 μin./°F) for deviation means and from 0.22 μm/°C (5 μin./°F) to 1.5 μm/°C (32 μin./°F) for TIR. TIR results exhibited the greater uncertainty, and thus, some of the effects on TIR were not significant. Also, variability was greater at the 45 degree latitude and the pole than at the equator. 12 figs., 1 tab.

1002 **Plasma flow processes within magnetic nozzle configurations.** York, T.M.; Mikellides, P.; Jacoby, B.A. 10p. AIAA, Monterey, CA (US) (1989). (AIAA-Paper–89-2711;CONF-8907118–: 25. American Society of Mechanical Engineers joint propulsion conference, Monterey, CA (USA), 10-13 Jul 1989).

An attempt is made to separate the interactive processes occurring in electromagnetic devices and to examine the acceleration of ionized gas within magnetic fields which can guide it through an expansion process. The plasma was generated in a single turn coil 50 cm long with a radius of 5.25 cm which surrounded a quartz tube with an internal radius of 3.81 cm and a length of 100 cm. Choking was found to occur at both sonic and cusp velocities which were coincident in the present experiment. 14 refs.

1003 **Criticality experiments with mixed plutonium-uranium nitrate solution at plutonium fraction of 0.5, 0.4, and 0.2 in slab and cylindrical geometry.** Lloyd, R.C.; Funabashi, H. *Transactions of the American Nuclear Society (USA),* 57: 127-129 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The objective of these experiments is to provide criticality data for (Pu + U) solutions for use in optimizing the physical size of equipment used in nuclear reprocessing plants. Prior to these measurements, little criticality data were available for mixed plutonium-uranium solutions in slab and cylindrical geometry. The experiments were performed under a joint Criticality Data Development Program between the US Department of Energy, and the Power Reactor and Nuclear Fuel Development Corporation of Japan. The critical experiments were performed in the Critical Mass Laboratory of the Pacific Northwest Laboratory. Criticality measurements were made with (Pu + U) nitrate solutions in slab and cylindrical geometry. The concentration of (Pu + U) in the nitrate solution was varied and ranged between 105 and 468 g (Pu + U)/l. The ratio of plutonium to (Pu + U) in the solution also was varied with measurements being made at 0.5, 0.4, and 0.2.

1004 **Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry.** Smolen, G.R. (Oak Ridge National Lab., TN (USA)); Funabashi, H. *Transactions of the American Nuclear Society (USA),* 57: 129-131 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

This paper outlines the results of a calculational study that was performed to validate two versions of the SCALE computer code system using data from critical experiments performed with mixed Pu + U aqueous solutions. The critical experiments were conducted in a 35-cm-diam cylinder and variable thickness slab tank. These experimental activities are part of a joint exchange program between the US Department of Energy (DOE) and the Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan in the area of criticality data development. The Consolidated Fuel Reprocessing Program (CFRP) at Oak Ridge National Laboratory (ORNL) manages the program for DOE. The experiments were conducted at the Battelle-Pacific Northwest Laboratories-Critical Mall Laboratory. Calculated multiplication factors have been examined for 36 critical experiments conducted in cylindrical and slab geometries with mixed Pu + U solutions. The results indicate that both the SCALE-2 and SCALE-4.0 computer code systems are capable of accurately modeling mixed fissile systems in simple geometry.

1005 **A k_{eff} search and optimization using noisy differentials.** Smith, N.R.; Brissenden, R.J. *Transactions of the American Nuclear Society (USA),* 57: 131 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

A common problem encountered by the criticality engineer is that of establishing worst-case or optimum conditions for a system subject to certain constraints. This is an essential part of criticality analysis, and the engineer needs not only to be able to assess the possible accident conditions, but also to take account of the more expected variations of the parameters that define a system. A k_{eff} search and optimization algorithm has been produced for the Monte Carlo criticality computer code MONK6, to assist the engineer in performing such assessments. It is able to solve certain types of

criticality assessment problems more efficiently than by alternative methods, as well as being easier to use. An additional benefit is the calculation of statistical uncertainties on the optimum conditions, which are not easy to determine using existing techniques. Since the amount of extra work involved for each additional parameter is slight, the method becomes more and more economical as the number of parameters increases.

1006 A comparison between criticality analyses for unreflected systems by Monte Carlo codes MCNP and MONK6A. Morioka, Shinichi; Kadotani, Hiroyuki; Hariyama, Yoshiharu; Smith, N.R. *Transactions of the American Nuclear Society (USA),* 57: 131-133 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

For unreflected systems where neutron leakage is large, the calculated k_{eff} is smaller than the experimental k_{eff}. For example, an analysis of the criticality experiment for the uranyl-nitrate solution slab-cylinder system was given at the International Seminar on Criticality Safety (ISCS) in Tokyo. At that seminar, both the results obtained by MCNP and KENO indicated smaller k_{eff} than the experimental one in the case of the system without any external reflectors. In this paper, the authors analyze the criticality problem for the same unreflected system considered at the ISCS in more detail. Comparing the 1.2% effect to d_{eff} due to the environment with the 2.2% increase of k_{eff} due to the measurement uncertainty, it is presumed that the contradiction between the calculations and the experiment of the present unreflected system is mainly caused by the large experimental uncertainties rather than by the environment effect.

1007 Californium-252-source-driven noise analysis measurements for six interacting safe bottles of aqueous uranyl nitrate. Mihalczo, J.T. (Oak Ridge National Lab., TN (USA)); Blakeman, E.D.; Ragan, G.E. *Transactions of the American Nuclear Society (USA),* 57: 133-134 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The subcritical neutron multiplication factor has been measured by the ^{252}Cf-source-driven noise analysis method for a configuration of six interacting safe polyethylene bottles (4.5-in.-diam, 12-l capacity) of aqueous uranyl nitrate. These experiments are the first application of this method of measuring subcriticality for an interacting system of six storage bottles and thus further assess the capability of this method for interacting arrays. This work is the initial part of a program for the measurement of large storage arrays.

1008 Analysis of a hypothetical criticality excursion during misloading of a high-capacity spent-fuel cask. Roberts, M.W.; Dodds, H.L. Jr. *Transactions of the American Nuclear Society (USA),* 57: 135-136 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In recent years, a considerable amount of research has been devoted to the analyses of criticality excursions occurring in spent-fuel casks. Several analyses have been performed to determine the consequences associated with criticality excursions initiated as a result of fuel assembly movement during transport of spent fuel and water reflood of casks containing irradiated fuel pins. Recently, efforts to increase the capacity of casks by taking credit for fuel burnup in the design of new casks have been undertaken. Misloading a cask with fuel of higher reactivity than the cask is designed for (e.g., loading fresh fuel into a cask designed for burned fuel) can result in a criticality accident and a subsequent transient excursion. During the transient, the cask and fuel are cooled via natural convection by the water in the spent-fuel storage pool. This paper presents a simple analysis of the neutronic and thermal-hydraulic consequences associated with such a PWR accident scenario.

1009 Application of superconductors to motors, generators, and transmission lines. Kirtley, J.L. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Electromagnetic and Electronic Systems); Edeskuty, F.J. *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(8): 1143-1154 (Aug 1989).

Superconductors are of interest to the designers of electric power equipment because they can carry current without loss, currents that are large enough to make very intense magnetic fields. This means that superconductors, used in suitable applications, can make electric power equipment smaller, lighter, more efficient, and perhaps with better dynamic response. Two specific applications are considered here: electric machinery (motors and generators) and transmission lines. The so-called high-T_c superconductors will have beneficial impact on motors, generators, and transmission lines only if conductors with sufficient mechanical properties and current-carrying capabilities can be developed.

1010 Conventional wire and cable technology. Gregory, E. (IGC/Advanced Superconductors, Inc., Waterbury, CT (USA)). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(8): 1110-1123 (Aug 1989).

In this article the present state of the art of practical bulk superconductors is reviewed. The recent developments in high-current-density fine-filament NbTi conductors are dealt with at length. The improvements achieved can be applied to the full range of different product forms of mono- and multifilamentary NbTi. These are described together with the fabrication methods used to produce them. Three practical fabrication techniques for multifilamentary Nb_3Sn are outlined and properties obtained are compared and discussed. Brief reference is made to V_3Ga, NbN, and Chevrel phases, and the novel fabrication techniques used to produce these materials. It is pointed out that the lessons learned in the manufacture of these compound superconductors can be used to help in the development of the newer high-T_c materials.

1011 Superconducting components for infrared and millimeter-wave receivers. Richards, P.L. (California Univ., Berkeley, CA (USA). Dept. of Physics); Hu, Q. *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(8): 1233-1246 (Aug 1989).

The supreconducting components that have been developed for infrared and millimeter-wave receivers are reviewed. A brief description is given of the scientific principles on which each device is based, followed by a discussion of the performance that has been achieved in terms of the appropriate figures of merit. Finally, comments are made about the possibility that useful device performance can be achieved by using the new high-T_c oxide superconductors. This review emphasizes photon-assisted quasi-particle tunneling and the SIS quasi-particle mixer, which is the only superconducting component to find substantial applications as infrared or millimeter wavelengths. Descriptions are given of the SIS quasi-particle direct detector, the Josephson effect oscillator, the Josephson effect parametric amplifier, and the various superconducting bolometers for which practical applications appear possible. The less promising Josephson effect detector and mixer and the various ideas for superconducting photon detectors are described because of the current interest in possible high-T_c versions of these devices.

1012 Principles and applications of SQUIDs. Clarke, J. (California Univ., Berkeley, CA (USA). Dept. of Physics). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(8): 1208-1223 (Aug 1939).

Superconducting quantum interference devices (SQUIDs) combine flux quantization and Josephson tunneling to produce an output voltage that is periodic in the applied magnetic flux with a period of one flux quantum Phi_o. SQUIDs are thus flux-to-voltage transducers, and are able to detect changes in flux much smaller that Phi_o. Using Nb-based thin-film technology, a number of groups can now routinely fabricate dc SQUIDs with input circuits integrated on the same chip. At 4.2 K the dc SQUID, which operates with a constant bias current, can detect signals with an equivalent energy per unit bandwidth of a few hundred h-bar. At low frequencies, the SQUID exhibits l/f noise that originates in fluctuations in the critical current of the junctions and in the motion of magnetic flux trapped in the thin films. RF SQUIDs, which operate with an RF flux bias, are usually machined from bulk Nb, and have a typical energy sensitivity per unit bandwidth of 10^5 to 10^6 h-bar. Both types of SQUID can be used in a wide variety of applications, including magnetometers, gradiometers, susceptometers, voltmeters, RF amplifiers, gravity wave antennas, and gravity gradiometers.

1013 Compact torsatron reactors. Lyon, J.F. (Oak Ridge National Lab., TN (USA)); Carreras, B.A.; Lynch, V.E.; Tolliver, J.S.;

Sviatoslavsky, I.N. *Fusion Technology (USA)*, 15(3): 1401-1419 (May 1989).

Low-aspect-ratio torsatron configurations could lead to compact stellarator reactors with R_0 = 8 to 11 m, roughly one-half to one-third the size of more conventional stellarator reactor designs. Minimum-sized torsatron reactors are found using various assumptions. Their size is relatively insensitive to the choice of the conductor parameters and depends mostly on geometrical constraints. The smallest size is obtained by eliminating the tritium breeding blanket under the helical winding on the inboard side and by reducing the radial depth of the superconducting coil. In this article engineering design issues and reactor performance are examined for three examples to illustrate the feasibility of this approach for compact torsatron reactors and for a medium-sized copper coil torsatron ignition experiment.

1014 PLC-based interlock system for superconducting magnets. Agostini, R.C. (Stanford Univ., CA (USA)); Barker, L.; Hodgers, J.; Reagan, D.; Walz, H.V. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA)*, 36(5): 1741-1745 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Conventional interlock systems rely heavily on hard-wired electromagnetic relays. Although this approach is well understood and has proven to be reliable, several drawbacks plague the designer as well as the repairman. If larger systems have to be implemented in relay logic, the complexity limit is soon reached; the systems become too bulky, and wiring expenses sky-rocket; moreover, the intelligence of those designs is limited in such a way that desirable features such as self-tests have to be left out. Additionally, relay interlocks are inherently inflexible: if the configuration of the system they protect has to change, a disproportional amount of time, work and money has to be invested in order to adapt the hard-wiring of the interlock system to the new requirements. Repair work is often unnecessarily delayed due to the lack of adequate documentation.

1015 Low temperature cryoprobe. Sungaila, Z.F. To Dept. of Energy, Washington, DC. USA Patent 4,831,846. 23 May 1989. Filed date 12 Apr 1988. Int. Cl. F25B 19/00. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A portable, hand held probe usable within a small confine is described to produce a point source of nitrogen or helium at a relatively constant temperature of 77 degrees Kelvin.

1016 Superconductor precursor mixtures made by precipitation method. Bunker, B.C.; Lamppa, D.L.; Voigt, J.A. To Dept. of Energy, Washington, DC. USA Patent 4,839,339. 13 Jun 1989. Filed date 25 Feb 1988. 12p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This pattern discusses method and apparatus for preparing highly pure homogeneous precursor powder mixtures for metal oxide superconductive ceramics. The mixes are prepared by instantaneous precipitation from stoichiometric solutions of metal salts such as nitrates at controlled pH's within the 9 to 12 range, by addition of solutions of non-complexing pyrolyzable cations, such as alkyammonium and carbonate ions.

1017 Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures. Leupold, H.A. To Department of the Army, Washington, DC (US). USA Patent 7-355,582. 19 May 1989. 11p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The general object of this invention is to take advantage of the high saturation magnetization of the ferromagnet material gadolinium to charge a superconductive ring even when the gadolinium has a lower transition temperature than the superconductive material. The aforementioned objects can be attained by a method including the steps of: placing a bar of a ferromagnet material in an annular ring of superconductive material at a temperature above both the transition temperature of the ferromagnet material and the transition temperature of the superconductive material; applying an axial magnetic field of sufficient strength to saturate the ferromagnet when the ferromagnet is cooled to below its transition temperature; cooling the ferromagnet to below its transition temperature without cooling the superconductive material so that the superconductive material does not become superconducting before the saturation of the ferromagnet; cooling the superconductive material to below its transition temperature; removing the ferromagnet and the applied field; and allowing the system to warm to a convenient operating temperature that must be below the transition temperature of the superconductive material.

4203 Lasers

Refer also to citation(s) 329, 1068, 1069, 1078, 1219, 1905, 1909, 1974

1018 (AD-A-205014/4/XAB) **Development of the cn- solid-state vibrational laser. Final report, 1 August 1985-31 October 1988.** Sievers, A.J.; Pollock, C.R. Cornell Univ., Ithaca, NY (USA). Lab. for Atomic and Solid State Physics. 17 Jan 1989. 40p. Available from NTIS, PC A03/MF A01.

The discoveries of the solid-state CN- vibrational laser of the efficient generation at subharmonics of the pump frequency by overtone IR pumping and of population inversion in the vibrational manifold produced by nonresonant pumping in the UV were all made under this grant. The unexpected findings indicate that the vibrational dynamics of molecules in solids is more subtle than previously expected. Our IR pumping experiments have demonstrated for the first time the feasibility of solid-state mid-infrared lasers based on purely vibrational transitions of molecular purities embedded in a host matrix. In the first experiments, pulsed oscillation at 2054/cm was obtained on the 2-> 1 transition of CN- ions in potassium bromide host following pulsed optical pumping of the CN- lower laser level. Subsequent research then focused on the response of directly pumping the upper vibrational laser level by means of a color-center laser tuned to the weakly allowed first overtone transition.

1019 (AD-A-209626/1/XAB) **Nd:BEL laser pumped by laser diodes.** Scheps, R.; Myers, J.; Schimitschek, E.J.; Heller, D.F. Naval Ocean Systems Center, San Diego, CA (USA). Jan 1988. 10p. Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of SPIE - The International Society for Optical Engineering, Vol. 898, 91-98(11-12 Jan 1988).

Performance data for a laser-diode-pumped c-w Nd:BEL laser is presented. Two phased laser-diode arrays are used as the pump source, each emitting 500 mW. The heat sink for the arrays is temperature controlled to allow for wavelength tunability. A Nd:YAG rod was pumped under similar conditions and the results are compared. Although the absorption bandwidth for Nd:BEL is substantially broader than for Nd:YAG, the Nd:BEL was found to have a higher threshold for lasing. Both rods gave slope efficiencies of 42%. The dependence of the output power on output mirror reflectivity was measured, with Nd:BEL showing a greater sensitivity to reflectivity than Nd:YAG. The optimum reflectivities were found to be .98 and .97 for Nd:BEL and Nd:YAG respectively. The maximum TEMoo c-w power achieved for each rod at these reflectivities was 250 mW for Nd:BEL and 283 mW for Nd:YAG. The observed electrical to optical conversion efficiency was factored into a product of analytic component terms and excellent agreement was found between observed and calculated efficiencies. Under the conditions used in this work, both BEL and YAG hosts perform comparably.

1020 (AD-A-209627/9/XAB) **End-pumped Nd:BEL laser performance. Professional paper.** Scheps, R.; Myers, J.; Schimitschek, E.J.; Heller, D.F. Naval Ocean Systems Center, San Diego, CA (USA). Sep 1988. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Optical Engineering, Vol. 27, No. 9, 830-834(Sep 1988).

Performance data for a c-w Nd:BEL laser end pumped by two 500-mW laser-diode arrays are presented and compared with the performance data for a Nd:YAG laser in a similar configuration. The phased arrays used as the pump source are cooled by a temperature-controlled heat sink to permit wavelength tunability. Although the absorption bandwidth for Nd:BEL is substantially broader than for Nd:YAG, the Nd:BEL was found to have a higher threshold for lasing. Both rods gave slope efficiencies of 42%. The dependence of the output power on output mirror reflectivity was measured, with Nd:BEL showing a greater sensitivity to reflectivity than Nd:YAG. The optimum reflectivities were found to be 0.98 for

Nd:BEL and 0.97 for Nd:YAG. The maximum TEM00 c-w power achieved for each rod at these reflectivities was 250 mW for Nd:BEL and 283 mW for Nd:YAG. The observed electrical-to-optical conversion efficiency was factored into a product of analytic component terms, and excellent agreement was found between observed and calculated efficiencies. It is concluded that under the conditions used in this work, both BEL and YAG hosts perform comparably. The conditions under which BEL might out-perform YAG as a host for diode-pumped Nd are discussed.

1021 (AD-A–209653/5/XAB) **Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988.** Bekefi, G. Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics. Mar 1989. 40p. Available from NTIS, PC A03/MF A01.

Profile modification by optical guiding in a Raman free-electron laser operating at microwave frequencies was studied experimentally. A cyclotron autoresonance maser (CARM) amplifier was designed, built, and tested. This CARM operates at 35 GHz with a power output of 10 MW and an efficiency of 3%. Observations of Field Profile Modifications in a Raman Free-Electron Laser Amplifier: The author reports measurements of the spatial distribution of the RF electric-field intensities and phases induced in a free-electron laser amplifier operating in the collective (Raman) regime. The studies are carried out at a microwave frequency of about 10 GHz in a FEL using a mildly relativistic electron beam of about 200 keV energy and 1 - 4A current. The probing of the ponderomotive (space charge) and the electromagnetic waves is accomplished by means of small movable electric dipole antennas inserted into the interaction region. A 35-GHz Cyclotron Autoresonance Maser Amplifier: studies of a cyclotron autoresonance maser are presented. The measurements are carried out at a frequency of 35 GHz using a mildly relativistic electron beam (1.5 MeV, 260 A) generated by a field-emission electron gun followed by an emittance selector that removes the outer, hot electrons. Perpendicular energy is imparted to the electrons by means of a bifilar helical wiggler. Measurements give a small signal gain of 90 dB/m and a saturated power output of 10 MW. The corresponding electronic efficiency is 3%. Computer simulations are also presented.

1022 (AD-A–209740/0/XAB) **High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim).** Godlove, T.F.; Sprangle, P. Naval Research Lab., Washington, DC (USA). 16 May 1989. 50p. (NRL-MR–6463). Available from NTIS, PC A03/MF A01.

The free-electron laser (FEL) has been developed to the point where projections of its high-power capability have made it an important component of the directed-energy research program within the Strategic Defense Initiative. To achieve the desired near-visible wavelength and high intensity, stringent demands are placed on the electron beam that drives the FEL. Typical requirements are high peak current (0.2 to 2 kA) at a kinetic energy of 100 to 150 MeV, small energy spread (<1%), small diameter (<3mm), and low divergence (<0.1 mrad). Either an induction linear accelerator (linac) or an rf linac may be a suitable candidate to provide the electron beam. This review describes the technical issues and technology needed to achieve a visible light FEL driven by an rf linac. A recently installed linac at Boeing Aerospace is used as the principal illustrative example. Keywords: Free electron laser; Particle accelerator; RF linac; Strategic defense initiative; Electron beam. (jhd)

1023 (AD-A–209802/8/XAB) **Bibliography of Soviet laser developments: January-February 1988.** Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence. 21 Feb 1989. 138p. (DIA-DST–2700Z-007-89). Available from NTIS, PC A07/MF A01.

This is the Soviet Laser Bibliography for January-February 1988, and is No. 93 in a continuing series on Soviet laser developments. The coverage includes basic research on solid-state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications systems; beam propagation; adaptive optics; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

1024 (AD-A–209847/3/XAB) **Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989.** Quinn, J.W. Optical Society of America, Washington, DC (USA). 1 Mar 1989. 171p. Available from NTIS, PC A08/MF A01.

The meeting dealt with the development and application of sources of coherent radiation from the extreme ultraviolet to the x-ray spectral region. Closely related areas of interest are multiphoton phenomena, soft x-ray optics, and laser-produced plasmas. Topics covered included: short-wavelength lasers, free-electron lasers and undulators, harmonic generation and frequency conversion, short wavelength optics and novel instrumentation, laser plasma radiation sources, multiphoton phenomena, ultrafast short-wavelength sources, applications in spectroscopy, and microfabrication, phase-coherent applications: holography and interferometry, and unique applications of short-wavelength sources.

1025 (AD-A–209870/5/XAB) **Laser-mixing processes. Final report, 1 July 1977-31 October 1978.** Russell, D.A. Washington Univ., Seattle, WA (USA). Coll. of Engineering. 1979. 10p. Available from NTIS, PC A02/MF A01.

The high-energy laser was made possible by the application of high speed fluid flow to basic molecular processes. The flow is used to remove waste heat, to provide a high mass flow for compactness and a high total pressure for gas recovery, to enhance lasing through reduced cavity temperatures, and to drop the density and thus the flow uniformity necessary for beam quality. Further, it is the rapid expansion of the plenum gas that provides non-equilibrium energy for the gasdynamic laser (GDL), and provides fast mixing and upstream isolation for the chemical supersonic diffusion laser (SDL). Thus, the 20-50 kw/kgm/sec output of modern high-energy lasers is integrally tied to the development of a new class of fluid flows involving non-equilibrium/reacting gases in a radiation-extraction cavity. High flow quality is essential if the laser beam is not to be degraded, and the wave systems, wakes, mixing layers, turbulence levels, and wall layers must be controlled. Consideration must be given to combustion processes in plenums and mixing layers, heat transfer in the expansion nozzles, aerodynamic beam-extraction windows, and downstream recovery of the working fluid to ambient conditions, in addition to the obvious concerns of efficiency and size. There are thus many reasons why laser possibilities are often paced by fluid dynamics.

1026 (AD-A–209913/3/XAB) **Pigtailed single-mode diode lasers. Final report, 20 September 1988-30 April 1989.** Kwong, N. Ortel Corp., Alhambra, CA (USA). 30 Apr 1989. 33p. Available from NTIS, PC A03/MF A01.

In choosing a scheme for single-mode fiber coupling, the final evaluation should of course be based on an experimental comparison between the alternative. However, such an evaluation will generally not reveal the essential limitations of any scheme. While the possible sources of less-than-ideal performance are well known, their relative significance is not so obvious. It is clear that in order to make significant improvements in the state of fiber-coupling technology, the relevant limitations must be clarified in order to guide further efforts in fruitful directions. As such, we have conducted an analysis of several aspects of the fiber-coupling problem which is presented here. Preliminary to the consideration of any particular system, the importance of the zeroth- and first-order properties of the coupling system are briefly discussed. To go beyond this, the higher-order aberrations of the optical coupling system must be included in the analysis. To do this, an algorithm to calculate the mode coupling performance of any optical system was developed using the ray-tracing features of an optical design program. This algorithm is described along with the results of an analysis of coupling with graded index lenses which have been found to work well experimentally.

1027 (AD-A–209998/4/XAB) **New, efficient optically pumped solid-state lasers. Final report, 15 August 1984-14 November 1988.** Bass, M.; Birnbaum, M. University of Southern California, Los

Angeles, CA (USA). Center for Laser Studies. 21 Feb 1989. 51p. Available from NTIS, PC A04/MF A01.

This effort explored the effects on laser operation of ion-ion interactions in crystalline solids. The authors work on the doubly-doubly Nd, Er:YAG and Nd, Ho:YAG lasers demonstrated not only simultaneous lasing of both ionic species but also drastic lifetime productions in the lower laser states of both Er and Ho. This work has enabled them to predict crystals in which 4 level operations at 2.9 microns can be achieved, and initial verification was obtained with Er,Nd: YALO.

1028 (DOE/SF/17128–T1) **A compact, high-powered far-infrared (FIR) laser: Technical progress report, January 22, 1988 to present.** Connecticut Coll., New London, CT (USA). 18 Aug 1989. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC03-87SF17128. Order Number DE89016786. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A compact CO_2–$^{13}CH_3F$ laser system where the FIR laser cavity is inserted in a pump, three-mirror CO_2 laser cavity, with optically-switched semiconductor cavity-dumping, will be designed and tested. The 1.207 mm cavity-dumped oscillator is expected to be characterized by predominantly single longitudinal mode, narrow linewidth operation and to produce peak powers of order 100 kW in pulses of order 10 ns duration. The 1.2mm wavelength lies in an atmospheric transmission window (1 dB/km at sea level), which opens up the possibility of millimeter-wave space- or ground-based radar and communications systems. The laser can also be used as a FIR spectroscopic source to investigate dynamic properties of elementary excitations of the solid state. Although much progress has been made, the project is behind schedule due to a malfunctioning pump CO_2 laser. An extension has been requested and it is anticipated that testing of the laser system can begin shortly.

1029 (ESA-TT–1120) **On the small-signal gain of free-electron lasers in the low-current region.** Spindler, G. European Space Agency, 75 - Paris (France). Nov 1988. 48p. (DFVLR-FB–87-10;ETN–89-94234). Available from NTIS, PC A03/MF A01; original German version available from DFVLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, DM 15.

A physically transparent method for calculating the small-signal gain of a free-electron laser (FEL) in the low-current regime is presented. The approach, performed within the framework of the single-particle model, makes explicit use of the modulation of the electron distribution function (bunching). In comparison with the usual method (expansion of the energy perturbation to second order by the amplitude of the signal wave; averaging over a homogeneous initial distribution) a gain formula with a factor twice as high in case of the FEL with a helical periodic wiggler is obtained. This is in best agreement with the Stanford-Experiment (1975). For the wiggler-free FEL (gyration in a homogeneous longitudinal magnetic field in combination with relatistic longitudinal motion) there are significant deviations of the gain formula with respect to published results.

1030 (LA-UR–89-3486) **Analytical treatment of electron trajectory straightener issues in free-electron lasers.** Elliott, C.J.; Quimby, D.C. Los Alamos National Lab., NM (USA). [1989]. 23p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-8908134–13: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002405. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The poincare orbit of the electron's journey must be straight and narrow through a many period FEL. To utilize an available technology level, the straightest wiggler orbit operating point (SWOOP) is chosen by adjusting the spacing parameter of an orbit correction scheme. This eases the requirements for achieving the full potential of FEL wigglers. One quality index, one cost index, two quality factors, two measures of field noise, an improvement index, and a straightener classification scheme are concepts that facilitate the analysis. Only when the field noise is large, is this analysis of direct use. A reader-friendly description culminates in the comparison of two schemes to illustrate the methods. Two coupled first order langevin equations have solutions that are proven to be gaussian variables. The solutions are used to give the required cross correlations. These results are coupled with a simple graphical technique and give an expression for the angular variance in the correction corridor. The two components of this variance are compared to a fiducial scheme and yield the two quality factors from which the quality, improvement and cost indices are computed. 68 refs., 5 figs.

1031 (N–89-17855) **Analysis of Nd3+:glass, solar-pumped, high-powr laser systems.** Zapata, L.E.; Williams, M.D. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Feb 1989. 13p. (NASA-TP–2905;L–16085;NAS–1.60:2905). Available from NTIS, PC A03/MF A01.

The operating characteristics of Nd(3+):glass lasers energized by a solar concentrator were analyzed for the hosts YAG, silicate glass, and phosphate glass. The modeling is based on the slab zigzag laser geometry and assumes that chemical hardening methods for glass are successful in increasing glass hardness by a factor of 4. On this basis, it was found that a realistic 1-MW solar-pumped laser might be constructed from phosphate glass 4 sq m in area and 2 mm thick. If YAG were the host medium, a 1-MW solar-pumped laser need only be 0.5 sq m in area and 0.5 cm thick, which is already possible. In addition, Nd(3+) doped glass fibers were found to be excellent solar-pumped laser candidates. The small diameter of fibers eliminates thermal stress problems, and if their diameter is kept small (10 microns), they propagate a Gaussian single mode which can be expanded and transmitted long distances in space. Fiber lasers could then be used for communications in space or could be bundled and the individual beams summed or phase-matched for high-power operation.

1032 (N–89-17856) **Design of catalytic monoliths for closed-cycle carbon dioxide lasers. Final report.** Herz, R.K.; Guinn, K.; Goldblum, S.; Noskowski, E. California Univ., San Diego, La Jolla, CA (USA). Feb 1989. 65p. (NASA-CR–184790;NAS–1.26:184790). Available from NTIS, PC A04/MF A01.

Pulsed carbon dioxide (CO_2) lasers have many applications in aeronautics, space research, weather monitoring and other areas. Full exploitation of the potential of these lasers in hampered by the dissociation of CO_2 that occurs during laser operation. The development of closed-cycle CO_2 lasers requires active CO-O_2 recombination (CO oxidation) catalyst and design methods for implementation of catalysts in CO_2 laser systems. A monolith catalyst section model and associated design computer program, LASCAT, are presented to assist in the design of a monolith catalyst section of a closed cycle CO_2 laser system. Using LASCAT,the designer is able to specify a number of system parameters and determine the monolith section performance. Trade-offs between the catalyst activity, catalyst dimensions, monolith dimensions, pressure drop, O_2 conversion, and other variables can be explored and adjusted to meet system design specifications. An introduction describes a typical closed-cycle CO_2 system, and indicates some advantages of a closed cycle laser system over an open cycle system and some advantages of monolith support over other types of supports. The development and use of a monolith catalyst model is presented. The results of a design study and a discussion of general design rules are given.

1033 (N–89-26220) **Comparison of laser models. Progress report, period ended 15 May 1989.** Heinbockel, J.H. Old Dominion Univ., Norfolk, VA (USA). Jun 1989. 14p. (NASA-CR–185390;NAS–1.26:185390). Available from NTIS, PC A03/MF A01.

Progress on the comparison of laser models is reported. Equations for an oscillatory model and a nonoscillatory model for the simulation of iodine laser operation are solved. Reaction rate coefficients used in both models are listed. Currently there are four models for the simulation of an iodine laser. They are: (1) a time dependent model; (2) a quasi-steady state model; (3) a noncompressible model; and (4) a compressible flow laser model. Current research is being directed toward: (1) parameter studies using the compressible flow laser model; (2) development of a two-pass amplifier model; and (3) solving a system of equations describing operation of the high powered iodine MOPA (master oscillator power amplifier).

1034 (ORNL/FTR–3416) **[Prospect for wavelength tunable lasers based on vacancy defects in alkaline-earth oxides]: Foreign trip report, September 18, 1989–September 30, 1989.** Chen, Y. Oak Ridge National Lab., TN (USA). 13 Oct 1989. 9p.

Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001538. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler presented an invited talk entitled "Prospect for Wavelength Tunable Lasers Based on Vacancy Defects in Alkaline-Earth Oxides" at the Fifth International Conference on Tunable Lasers in Irkutsk, Siberia, USSR. In addition, he also visited the Irkutsk State University in Irkutsk, Siberia, USSR; the General Physics Institute, the Academy of Sciences of the USSR, Moscow, USSR; and the Institute of Radioengineering and Electronics, the Academy of Sciences of the USSR, Moscow, USSR.

1035 (PB–89-193908/XAB) **$^{12}C^{16}O$ laser frequency tables for the 34.2 to 62.3 THz (1139 to 2079/cm) region.** Schneider, M.; Evenson, K.M.; Vanek, M.D.; Jennings, D.A.; Wells, J.S. National Bureau of Standards, Boulder, CO (USA). Time and Frequency Div. Aug 1988. 27p. (NBS/TN–1321). Available from NTIS, PC A03/MF A01.

Also available from Supt. of Docs. as SN003-003-02933-5.

Frequencies for (12)C(16)0 laser transitions are tabulated for the spectral range from 34.2 to 62.3 THz (1139 to 2079/cm). The transition frequencies were calculated using molecular constants derived by heterodyne frequency measurements on the (12)C(16)O laser.

1036 (PFC/JA–89-43) **Self-field-induced chaotic electron motion in free electron lasers.** Chen, Chiping; Davidson, R.C. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. Sep 1989. 17p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (CONF-8908134–14: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90001710. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It is shown that the inclusion of the equilibrium self fields of the electron beam results in chaotic electron motion in the field configuration consisting of a constant-amplitude helical wiggler magnetic field and a uniform axial guide field. The threshold value of the self-field parameter $\epsilon = \omega_{pb}^2/4\Omega_c^2$ is determined for the onset of chaoticity in the Group-I and Group-II orbits for the parameter regime corresponding to moderately high beam current (and density). The time scale for self-field-induced changes in the particle orbits is found to be of the order of beam-transit time through one wiggler period. 15 refs., 5 figs.

1037 **Long-pulse operation of a Nd:glass laser.** Maynard, R.L. (KMS Fusion, Inc., Ann Arbor, MI (USA)); Johnson, R.P.; Masters, F.J.; Moncur, N.K.; Siebert, L.D.; Stanley, J.G. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper TUJ28.

Recent interest in materials studies utilizing millisecond-regime laser pulses has led to development of such a laser system at KMS Fusion. The authors describe the configuration and performance of an Nd doped master oscillator/power amplifier system that incorporates electronic feedback control. A block diagram of the feedback system and an oscilloscope photograph illustrating the final system output and the corresponding compensating oscillator output wave shape are presented.

1038 **Wideband Nd:glass laser.** Stanley, J.G. (KMS Fusion, Inc., Ann Arbor, MI (US)); Siebert, L.D.; Johnson, R.P.; Moncur, N.K. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper TUJ42.

A broad bandwidth laser beam can help provide uniform illumination on fusion targets by reducing intensity modulations caused by coherent constructive interference of the laser beam in or near the focal volume. A pulsed laser oscillator has been developed that utilizes the naturally broad gain bandwidth of Nd:glass and the relatively wide free spectral range of a 50-μm thick quartz etalon to produce pulses at 1.054 μm with spectral shapes as wide as 5- A. The oscillator is discussed in this article.

1039 **Pulse train amplification in KrF.** Raymond, T.D. (Sandia National Labs., Albuquerque, NM (USA)); Reiser, C.; Adams, R.G.; Michie, R.B. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THU3.

Pulse-train amplification has been demonstrated to be an energy efficient means of increasing the peak output intensity from a discharge pumped KrF excimer amplifier. Recently, pulse-train amplification has attracted the interest of the inertial confinement fusion community because this technique has the potential to reduce the number of angular-multiplexed beam lines in their proposed systems. Since the gain is not continuously loaded during pulse-train amplification, amplified spontaneous emission (ASE) may limit the performance of high power amplifiers. In this work, the authors investigate the dynamics of gain recovery and ASE in a strongly pumped Krf amplifier. Their experimental apparatus consists of a dye laser based tunable front end, a discharge pumped KrF preamplifier, and an electron-beam pumped KrF amplifier.

1040 **Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs.** Vawter, G.A. (Sandia National Labs., Albuquerque, NM (USA)); Myers, D.R.; Brennan, T.M.; Hammons, B.E.; Hohimer, J.P. *IEEE Photonics Technology Letters (USA),* 1(7): 153-155 (Jul 1989).

The authors report the first implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure (IPBH-GF'NSCH) laser in (AlGa)As/GaAs. Ion implantation is used to form p-'-p-n current blocking layers and to create a buried-heterostructure waveguide. This results in significantly reduced fabrication complexity of high-quality, index-guided laser diodes compared to regrowth techniques, and in contrast to diffusion-induced disordering, allows for the creation of self-aligned, buried, blocking junctions. The authors demonstrate kink-free, CW operation of single-stripe IPBH-GRINSCH lasers along with single-lobed near- and far-field optical emission patterns, consistent with index-guided operation.

1041 **Compact short-wavelength free-electron laser.** Chang, D.B. (Hughes Aicraft Company, Long Beach, California 90810 (US)); McDaniel, J.C. *Physical Review Letters (USA),* 63(10): 1066-1069 (4 Sep 1989).

A new nonclassical model is proposed for the radiation from electrons skimming over and colliding at grazing incidence with a conducting diffraction grating. Radiation originating from induced surface currents and bremsstrahlung is amplified as it passes through spatially modulated wave functions above the grating. The predicted magnitude and dependence on electron beam thickness agree with experiments at visible wavelengths and suggest the possibility of a compact x-ray laser.

1042 **$3p^63d^8$–$3p^53d^9$ Transitions in ironlike Sb.** Ekberg, J.O. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000 (US)); Seely, J.F.; Feldman, U.; Brown, C.M. *Journal of the Optical Society of America B: Optical Physics (USA),* 6(9): 1648-1649 (Sep 1989).

Transitions of the type $3p^63d^8$–$3p^53d^9$ in Sb^{25+} have been identified in the spectrum from a plasma produced by irradiating a planar foil target, using line-focused laser irradiation. The wavelengths in the range 44–62 A were determined with an uncertainty of $\pm$0.007 A. Based on the 45 observed wavelength combinations, energy-level values were established for 9 levels of the $3p^63d^8$ configuration and 12 levels of the $3p^53d^9$ configuration with an uncertainty of 200 cm^{-1}. The wavelengths and energy levels were compared with previously observed and predicted values.

1043 **Observation of n=2–3 and n=3–4 transitions in Li-like Ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation.** Brown, C.M. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000 (US)); Ekberg, J.O.; Seely, J.F.; Feldman, U. *Journal of the Optical Society of America B: Optical Physics (USA),* 6(9): 1650-1651 (Sep 1989).

Transitions of the type n=2–3 and n=3–4 in P xiii, S xiv, Cl xv, and K xvii were observed in the spectra from linear plasmas. The

$3d$–$4f$ transitions were observed in all four ions and are of potential interest for x-ray lasers. The wavelengths of the transitions were determined with an uncertainty of ±0.010 A, and the observed wavelengths are compared with predicted and calculated values.

1044 Wavelengths and energy levels for Ge xxiv, Ge xxv, and Ge xxvi observed in plasmas produced by line-focus laser irradiation. Feldman, U. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000 (US)); Ekberg, J.O.; Brown, C.M.; Seely, J.F. *Journal of the Optical Society of America B: Optical Physics (USA),* 6(9): 1652-1655 (Sep 1989).

Transitions in Ge xxiv, Ge xxv, and Ge xxvi were observed in the spectra emitted from linear plasmas that were produced by irradiating planar targets using eight line-focused beams of the Omega laser. A 3-m grazing-incidence spectrograph viewed the plasma in the axial direction. The spectral lines were quite narrow owing to the reduced ion motion along the line of sight. Transitions of the type $2s^22p^j$–$2s2p^{j+1}$ (where j=3, 4, 5) and $2s2p^k$–$2p^{k+1}$ (where k=4, 5) were observed in the first through fifth spectral orders. The wavelengths were measured with an uncertainty of less than 0.010 A, and the energy levels were determined with an uncertainty smaller than 100 cm^{-1}.

1045 Blue-green (450-nm) upconversion Tm^{3+}:YLF laser. Nguyen, D.C. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Faulkner, G.E.; Dulick, M. *Applied Optics (USA),* 28(17): 3553-3555 (1 Sep 1989).

We report an upconversion laser that is pumped by two colors—one red and one near infrared—and emits in the blue-green region.

1046 Method and apparatus for optical communication by frequency modulation. Priatko, G.J. To Dept. of Energy, Washington, DC. USA Patent 4,791,630. 13 Dec 1988. Filed date 26 Sep 1986. Int. Cl. H04B 91/00. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

Laser optical communication according to this invention is carried out by producing multi-frequency laser beams having different frequencies, splitting one or more of these constituent beams into reference and signal beams, encoding information on the signal beams by frequency modulation and detecting the encoded information by heterodyne techniques. Much more information can be transmitted over optical paths according to the present invention than with the use of only one path as done previously.

1047 Polarization feedback laser stabilization. Esherick, P.; Owyoung, A. To Dept. of Energy, Washington, DC. USA Patent 4,791,633. 13 Dec 1988. Filed date 28 Sep 1987. Int. Cl. H01S 3/13. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a system for locking two Nd:YAG laser oscillators includes an optical path for feeding the output of one laser into the other with different polarizations. Elliptical polarization is incorporated into the optical path so that the change in polarization that occurs when the frequencies coincide may be detected to provide a feedback signal to control one laser relative to the other.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 366, 402, 427, 448, 450, 451, 456, 515, 972, 988, 1086, 1087, 1088

1048 (AGARD-CP–437-VOL-1) **Validation of Computational Fluid Dynamics. Volume 1. Symposium papers and round table discussion.** Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). Dec 1988. vp. (In several languages). (CONF-8805302–: Conference on validation of computational fluid dynamics, Lisbon (Portugal), 2 May 1988). Available from NTIS, PC A25/MF A01.

The specific intent of the examining activities, both computational and experimental, was directed toward validating or calibrating CFD codes over a broad spectrum of fluid dynamics study areas. The objectives of the Symposium were to identify the level of agreement of numerical solution algorithms and physical models with experimental and/or analytical data, to identify regions of validity for given flow solvers, and to identify flow regions where significant gaps exist and further work is warranted.

1049 (AGARD-CP–437-VOL-2) **Validation of Computational Fluid Dynamics. Volume 2: Poster papers.** Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). Dec 1988. vp. (CONF-880532–: American Nuclear Society topical meeting, Seattle, WA (USA), 1-5 May 1988). Available from NTIS, PC A11/MF A01.

AGARD's Fluid Dynamics Panel has sponsored a Symposium with the specific intent of examining activities, both computational and experimental, directed toward validating or calibrating computational fluid dynamics (CFD) codes over a broad spectrum of fluid-dynamics study areas. The objectives of the Symposium were to identify the level of agreement of numerical solution algorithms and physical models with experimental and/or analytical data, to identify regions of validity for given flow solvers, and to identify flow regions where significant gaps exist and further work is warranted.

1050 (AGARD-CP–437-VOL-2, pp. 12) **Finite difference methods in recirculating flows.** Pereira, J.C.F. (Erlangen-Nuremberg Univ. (Germany, F.R.)); Durst, F. Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). Dec 1988. (CONF-880532–: American Nuclear Society topical meeting, Seattle, WA (USA), 1-5 May 1988). In *Validation of Computational Fluid Dynamics. Volume 2: Poster papers.* Available from NTIS, PC A11/MF A01.

Numerical solutions of the two-dimensional Navier-Stokes equations using finite-difference approaches in which different numerical schemes for the discretization of the convective terms are used are discussed. The errors arising in the solution of the recirculating flows are mainly attributed to the convective discretization schemes and, hence knowledge of different numerical schemes is essential to accurately predict complex recirculating flows. To assess the performance of prediction schemes, it is necessary to carry out predictions in carefully selected laminar flows. For this reason the flows examined are all in the laminar regime and emphasis is given to numerical solutions with laser-Doppler measurements.

1051 (CONF-8906112–) **Proceedings of the seventh symposium on energy engineering sciences: Nonlinear mechanics and mechanical systems.** Argonne National Lab., IL (USA). [1989]. 239p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. symposium on energy engineering sciences; Argonne, IL (USA); 19-21 Jun 1989. Order Number DE90000872. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The Seventh Symposium on Energy Engineering Sciences was held on June 19–21, 1989 at the Argonne National Laboratory, Argonne, Illinois. These proceedings include the program, list of participants, and the papers that were presented during the eight technical sessions held at this meeting. This was the seventh such annual symposium sponsored by the Engineering Research Program of the Office of Basic Energy Sciences of the US Department of Energy. As the title indicates, the central themes of this year's meeting were Non-linear Mechanics and Mechanical Systems. Each year selected researchers in the DOE/BES Engineering Research Program are invited to present their research findings in such an open forum. By organizing around the two central topics principal investigators, their associates, and other interested parties can engage in discussions and share thoughts on subjects of common interest. This format has been used in the Engineering Research Program in place of annual contractors' meetings and has been extremely successful since its inception in 1983. The Symposium was organized into eight technical sessions: two dealt with fluid flow, and two addressed design and control, the others dealt with nonlinear systems, two-phase flow, heat transfer and solid mechanics. The breadth of topical material indicates the rich mixture of research supported by the DOE Engineering Program. The individual papers have been cataloged separately.

1052 (N–89-21191) **High capacity demonstration of honeycomb panel heat pipes. Final technical report.** Tanzer, H.J. Hughes Aircraft Co., Torrance, CA (USA). Feb 1989. 73p. (NASA-CR–181776;NAS–1.26:181776). Available from NTIS, PC A04/MF A01.

The feasibility of performance enhancing the sandwich panel heat pipe was investigated for moderate temperature range heat rejection radiators on future-high-power spacecraft. The hardware

development program consisted of performance prediction modeling, fabrication, ground test, and data correlation. Using available sandwich panel materials, a series of subscale test panels were augumented with high-capacity sideflow and temperature control variable conductance features, and test evaluated for correlation with performance prediction codes. Using the correlated prediction model, a 50-kW full size radiator was defined using methanol working fluid and closely spaced sideflows. A new concept called the hybrid radiator individually optimizes heat pipe components. A 2.44-m long hybrid test vehicle demonstrated proof-of-principle performance.

1053 (N–89-23818) **Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation.** Lin, Chinshun. Analex Corp., Cleveland, OH (USA); Analex Corp., Cleveland, OH (USA). Apr 1989. 22p. (NASA-CR–182285;E–4749;NAS–1.26:182285;AIAA–89-1744;CONF-8906134–: 24. AIAA thermophysics conference, Buffalo, NY (USA), 11-15 Jun 1989). Available from NTIS, PC A03/MF A01.

Final Report; sponsored by AIAA.

Numerical solutions of jet-induced mixing in a partially full cryogenic tank are presented. An axisymmetric laminar jet is discharged from the central part of the tank bottom toward the liquid-vapor interface. Liquid is withdrawn at the same volume flow rate from the outer part of the tank. The jet is at a temperature lower than the interface, which is maintained at a certain saturation temperature. The interface is assumed to be flat and shear-free and the condensation-induced velocity is assumed to be negligibly small compared with radial interface velocity. Finite-difference method is used to solve the nondimensional form of steady state continuity, momentum, and energy equations. Calculations are conducted for jet Reynolds numbers ranging from 150 to 600 and Prandtl numbers ranging from 0.85 to 2.65. The effects of above stated parameters on the condensation Nusselt and Stanton numbers which characterize the steady-state interface condensation process are investigated. Detailed analysis to gain a better understanding of the fundamentals of fluid mixing and interface condensation is performed.

1054 (N–89-23823) **Two-dimensional numerical simulation of a Stirling engine heat exchanger.** Ibrahim, M.B.; Tew, R.C.; Dudenhoefer, J.E. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 13p. (NASA-TM–102057;E–4815;NAS–1.15:102057;CONF-890815–: 24. intersociety energy conversion engineering conference, Arlington, VA (USA), 6-11 Aug 1989). Available from NTIS, PC A03/MF A01.

The first phase of an effort to develop multidimensional models of Stirling engine components is described; the ultimate goal is to model an entire engine working space. More specifically, parallel plate and tubular heat exchanger models with emphasis on the central part of the channel (i.e., ignoring hydrodynamic and thermal end effects) are described. The model assumes: laminar, incompressible flow with constant thermophysical properties. In addition, a constant axial temperature gradient is imposed. The governing equations, describing the model, were solved using Crank-Nicloson finite-difference scheme. Model predictions were compared with analytical solutions for oscillating/reversing flow and heat transfer in order to check numerical accuracy. Excellent agreement was obtained for the model predictions with analytical solutions available for both flow in circular tubes and between parallel plates. Also the heat transfer computational results are in good agreement with the heat transfer analytical results for parallel plates.

1055 (N–89-24578) **Domain decomposition algorithms and computation fluid dynamics.** Chan, T.F. Research Inst. for Advanced Computer Science, Moffett Field, CA (USA); Research Inst. for Advanced Computer Science, Moffett Field, CA (USA). Aug 1988. 19p. (NASA-CR–185405;NAS–1.26:185405;RIACS-TR–88.21;CONF-8806154–: 2. international conference on vector and parallel computing: issues in applied research and development, Tromso (Norway), 6-10 Jun 1988). Available from NTIS, PC A03/MF A01.

In the past several years, domain decomposition was a very popular topic, partly motivated by the potential of parallelization. While a large body of theory and algorithms were developed for model elliptic problems, they are only recently starting to be tested on realistic applications. The application of some of these methods to two model problems in computational fluid dynamics are investigated. Some examples are two dimensional convection-diffusion problems and the incompressible driven cavity flow problem. The construction and analysis of efficient preconditioners for the interface operator to be used in the iterative solution of the interface solution is described. For the convection-diffusion problems, the effect of the convection term and its discretization on the performance of some of the preconditioners is discussed. For the driven cavity problem, the effectiveness of a class of boundary probe preconditioners is discussed.

1056 (N–89-26184) **Workshop on Two-Phase Fluid Behavior in a Space Environment.** Swanson, T.D.; Juhasz, A.; Long, W.R.; Ottenstein, L. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. 1989. 45p. (NASA-CP–3043;REPT–89B00114;NAS–1.55:3043;CONF-8806433–: Workshop on two-phase fluid behavior in a space environment, Ocean City, MD (USA), 13 Jun 1988). Available from NTIS, PC A03/MF A01.

The Workshop was successful in achieving its main objective of identifying a large number of technical issues relating to the design of two-phase systems for space applications. The principal concern expressed was the need for verified analytical tools that will allow an engineer to confidently design a system to a known degree of accuracy. New and improved materials, for such applications as thermal storage and as heat transfer fluids, were also identified as major needs. In addition to these research efforts, a number of specific hardware needs were identified which will require development. These include heat pumps, low weight radiators, advanced heat pipes, stability enhancement devices, high heat flux evaporators, and liquid/vapor separators. Also identified was the need for a centralized source of reliable, up-to-date information on two-phase flow in a space environment.

1057 (PB–89-217921/XAB) **Doubly-fluted tubes and enhanced tubes in confined crossflow. Annual report, August 1987-July 1988.** Christensen, R.N.; Garimella, S. Ohio State Univ., Columbus, OH (USA). High-Energy Physics Lab. May 1989. 104p. Available from NTIS, PC A06/MF A01.

This report describes the results of an ongoing project to investigate the thermal hydraulic characteristics of spirally-enhanced tubes and annuli in heat-exchanger applications. Heat-transfer enhancement and pressure-drop increase data for the turbulent-flow regime available in the literature for over sixty spirally enhanced tubes fabricated by different manufacturers was analyzed. A geometric nondimensional parameter known as severity was used to collapse data for Nusselt number increase, friction factor increases, and enhancement efficiency for all these tubes.

1058 (SAND–89-1720) **Gelled propellant flow: Boundary layer theory for power-law fluids in a converging planar channel.** Kraynik, A.M.; Geller, A.S.; Glick, J.H. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 19p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC04-76DP00789. Order Number DE90000923. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A boundary layer theory for the flow of power-law fluids in a converging planar channel has been developed. This theory suggests a Reynolds number for such flows, and following numerical integration, a boundary layer thickness. This boundary layer thickness has been used in the generation of a finite element mesh for the finite element code FIDAP. FIDAP was then used to simulate the flow of power-law fluids through a converging channel. Comparison of the analytic and finite element results shows the two to be in very good agreement in regions where entrance and exit effects (not considered in the boundary layer theory) can be neglected. 6 refs., 8 figs., 1 tab.

1059 (UCID–21800) **Time-dependent free convection in liquid metals.** McClelland, M.A.; Meyer, P.J. Lawrence Livermore National Lab., CA (USA). Sep 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. Order Number DE90000957. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A numerical analysis is given for the time-dependent free convection of highly conductive liquids in a rectangular cavity. The results

are relevant to the electron beam vaporization of metals. The spatial problem is solved with the Galerkin finite element method, and the time integration is performed with a backward Euler method incorporating step-size control. Streamwise dispersion is introduced for cases involving large convection and numerical instabilities. Results are given for flows in the transition region between laminar and turbulent flow. 7 refs., 4 figs.

1060 **Drying of permeable media: Whitaker's paradox explained.** Bixler, N.E. (Sandia National Labs., Albuquerque, NM (US)). pp. 181 of The 5th Miami international symposium on multiphase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

Whitaker and Chou (1983) describe a seeming paradox in drying theory that occurs when a porous media exhibits an irreducible saturation. They describe an intermediate zone in which liquid cannot flow, because the relative permeability has fallen to zero, and the flow of vapor should be away from the drying front because of the imposed thermal gradient. Thus, they say, it would be impossible for drying to proceed once a portion of the domain has reached the irreducible saturation. They speculate that this apparent dilemma arises because their theory only includes diffusion in the gaseous phase. The paradox described by Whitaker and Chou has been investigated using a model that includes not only binary diffusion, but also Darcy flow due to pressure gradients and buoyancy in the gaseous phase. This model is implemented in a two-phase porous-flow code named NORIA.

1061 **Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus.** Rainwater, J.C. (National Institute of Standards and Technology, Boulder, CO (USA)). *International Journal of Thermophysics (USA)*, 10(2): 357-368 (Mar 1989). (CONF-880606–: 10. symposium on thermophysical properties, Gaithersburg, MD (USA), 20-23 Jun 1988).

Explicit functional representations are developed for constant-composition dew and bubble curves near critical according to the modified Leung-Griffiths theory. The pressure and temperature increments $\Delta P = P-P_c$ and $\Delta T = T-T_c$, where c denotes critical, are linearly transformed to new variables $\Delta P'$ and $\Delta T'$. In the transformed space, the coexistence curves are no longer double-valued and can be expressed as a nonanalytic expansion, where the coefficients are functions of the critical properties and their derivatives. A similar asymptotic expansion is developed for ΔT in terms of the density increment $\Delta\rho = \rho - \rho_c$. In the approximation that the critical exponents $\alpha = 0$ and $\beta = 1/3$, the critical point in temperature-density space is shown to be a point of maximum concave upward curvature, rather than an inflection point as previously conjectured.

4205 Materials Testing

Refer also to citation(s) 753, 992

1062 (AD-A–209941/4/XAB) **Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986.** Suh, N.P.; Saka, N.; Komvopoulos, K. Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Mfg. and Productivity. 30 May 1989. 75p. Available from NTIS, PC A04/MF A01.

The objective of the proposed research was to create hard layers on metallic surfaces in boundary-lubricated sliding and to investigate their tribological behavior. In addition, the goal was to investigate the basic mechanism of friction of lubricated metallic surfaces. The authors investigated the following aspects: (a) Experimental investigation of the tribological behavior of metallic and coated surfaces in boundary lubrication, and (b) Finite-element analysis of friction and wear of the coated surfaces, and the delamination process at the interface.

1063 (Juel-Spez–470) **Principles and methods for the testing of high-performance ceramics. A survey.** Kollenberg, W. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Material- und Rohstofforschung. Oct 1988. 73p. (In German). Available from Available from Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralbibliothek.

The objective of this study was to compile the fundamentals which are necessary for the standardization of testing methods for high-performance ceramics. The properties to be tested were those for which users and manufacturers consider test standards most necessary. For the description of the flexural strength there are mainly two fully developed methods: the 4-point bending test and the double ring test, so that a standard can be worked out in a short time. For the hardness test and the determination of thermal properties, existing standards (e.g. for the testing of glass) can be applied, which, with a few necessary alterations can be transferred to ceramics. The tensile testing and the determination of resistance to cracking, however, are not yet sufficiently developed. For the tensile testing, for example, a comparative testing with various specimen configurations and specimen supports is necessary. (MM).

1064 (PB–89-228274/XAB) **Development and use of a tribology research-in-progress data base.** Jahanmir, S.; Peterson, M.B. National Engineering Lab. (NBS), Washington, DC (USA). Jul 1989. 316p. (NISTIR–89/4112). Available from NTIS, PC A14/MF A01.

Portions of this document are not fully legible.

Preliminary efforts leading to the development of a research-in-progress data base on tribology are described. The data base contains brief abstracts of current tribology research being conducted by industry, universities, research institutes, and government laboratories based on a survey of active researchers. It also contains information on the types of activities, general areas of interest, program objectives, and tribology applications. The primary program objectives cited in connection with the tribology activities include long life, low maintenance, failure-free machinery, fundamental understanding, and materials development for improved performance.

1065 (PB–89-868970/XAB) **Nondestructive testing: X-ray radiography techniques. January 1975-October 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-October 1987.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 172p. Available from NTISPC N01/MF N01.

See also PB–89-868988.

This bibliography contains citations concerning x-ray radiographic techniques, equipment, and instruments for the nondestructive examination and testing of materials, objects, and structures. Nondestructive-assay methods and equipment are presented. Considerable attention is given to nondestructive stress measurement and analysis as well as the detection of flaws or structural defects. (This updated bibliography contains 378 citations, none of which are new entries to the previous edition.)

1066 (PB–89-868988/XAB) **Nondestructive testing: X-ray radiography techniques. November 1987-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for November 1987-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 38p. Available from NTISPC N01/MF N01.

Supersedes PB–87-869210. See also PB–89-868970.

This bibliography contains citations concerning x-ray radiographic techniques, equipment, and instruments for the nondestructive examination and testing of materials, objects, and structures. Nondestructive-assay methods and equipment are presented. Considerable attention is given to nondestructive stress measurement and analysis as well as the detection of flaws or structural defects. (This updated bibliography contains 53 citations, all of which are new entries to the previous edition.)

1067 (UCRL–101903) **Simulation of mechanical deformation via nonequilibrium molecular dynamics.** Hoover, W.G.; Hoover, C.G.; Stowers, I.F.; De Groot, A.J.; Moran, B. Lawrence Livermore National Lab., CA (USA). Aug 1989. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908158–2: Conference on microscopic simulation of complex flows, Brussels (Belgium), 21-25 Aug 1989). Order Number DE90000828. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We are developing two- and three-dimensional pair-force and embedded-atom simulations of mechanical deformation processes — indentation, machining, and inelastic ballistic-impact collisions — related to current nanometer machining practice. Here we describe these problems and their implementation using both mainframe and parallel-processor computers. 11 refs., 3 figs.

4208 Electronic Circuits and Devices

Refer also to citation(s) 888, 982, 983, 1021, 1024, 1210, 1343, 1702, 1979, 2009

1068 (AD-A–209645/1/XAB) **Solid-state research. Quarterly technical report, 1 May-31 July 1988.** McWhorter, A.L. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 7 Mar 1989. 100p. Available from NTIS, PC A05/MF A01.

Contents include: Time-Resolved Wavefront Measurement of a Pulsed Dye Laser Using Integrated Optics; GaP Microlenses by Mass Transport; A New OMVPE Reactor for Growth of InP and Related Alloys; Microchannel Heat Sinks for Two-Dimensional High Power-Density Diode Laser Arrays; Novel Scalloped-Mirror Diffraction-Coupled Laser Arrays; Three-Mirror Ti:Al_2O_3 Ring Laser Cavity; Femtosecond TiAl_2O_3 Injection-Seeded Laser; End-Pumped Nd:LaF_3 and Nd:LaMgA11O19 Lasers; Single Frequency Mixing of Frequency-Modulated Laser Radiation; Vertical Rotating-Disk OMVPE Reactor; New Electron Beam Lithography System; Dry-Etching-Induced Damage on Vertical Sidewalls of GaAs Channels; Homoepitaxial Semiconducting Diamond; 420 X 420 CCD Frame-Transfer Imager; Technique for Monolithically Integrating GaAs/AlGaAs Lasers of Different Wavelengths; Superconducting Thin Films of BiSrCaCuO; and Nb Thin-Film Capacitors for Superconductive Circuits.

1069 (AD-A–209936/4/XAB) **Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989.** Steier, W.H.; Sawchuk, A.A. University of Southern California, Los Angeles, CA (USA). 15 Apr 1989. 3p. Available from NTIS, PC A02/MF A01.

Research assistants supported by this grant have worked in a variety of optical-computing projects. These projects are summarized briefly in this report. Topics covered include: Optical interconnection networks; Integrated optoelectronic transceivers; Laser arrays; Array receivers; Optical processors; and Image understanding.

1070 (AD-A–209944/8/XAB) **Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989.** Jacobi, W.J. Space Computer Corp., Santa Monica, CA (USA). 14 Mar 1989. 35p. (SCC-R–104-F). Available from NTIS, PC A03/MF A01.

The basic goal of this project is to develop and demonstrate techniques for the reduction of power consumption of space-based processors for infrared-surveillance systems. The primary technique is to minimize the capacitive loading encountered in off-chip communications for highly concurrent processing architectures. Both processing architecture and chip packaging are simultaneously considered to maximize MOPS per watt by increasing throughput while reducing system capacitance, signal delay, noise, voltage swing, and power consumption (the costs of system communications). With conventional packaging technology, highly concurrent processing architectures result in hardware implementations that are extremely large, very heavy, and that consume excessive power. Monolithic wafer-scale integration is theoretically ideal but requires an extensive amount of redundant circuitry and provisions for circuit reconstructurability because of manufacturing yield problems. In the hybrid wafer-scale integration (HWSI) approach, individual pretested chips are bonded to a fine-line interconnect structure fabricated on the surface of a wafer-scale substrate. With this technique, high yields can be achieved without redundancy.

1071 (AD-A–209969/5/XAB) **Solid-state research. Quarterly technical report, 1 August-31 October 1988.** McWhorter, A.L. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 15 Nov 1988. 84p. Available from NTIS, PC A05/MF A01.

Contents include: microwave bandpass modulators in lithium niobate; surface-energy and temperature effect on etched structures in compound semiconductors - model of the mass transport phenomenon; kinetics of mass transport of etched structures in InP due to surface-energy minimization; a simple model of amplified spontaneous emission spectral narrowing high-power, diffraction-limited, narrowband external cavity diode laser; Si-on-insulator films prepared by zone-melting recrystallization with enhanced radiative heating; selective plasma etching of Si from GaAs-on-Si wafers; selective-area laser photodeposition of transparent conductive SnO_2 films; electrical characteristics of ultrashallow-junction diodes fabricated by laser doping; patterned excimer-laser etching of GaAs within a molecular beam epitaxy machine; PBT amplification at 94 GHz; a 64 x 64-pixel back-illuminated CCD imager with low noise and high frame rates; high-speed resonant-tunneling diodes made from the pseudomorphic in(0.53)ga(0.47) as/alas system; superconductive Nb thin-film capacitors with Ta_2O_5 dielectric; deposition of YBa_2Cu_3Ox films by sequential rf diode sputtering; and microwave surface resistance of BiSrCaCuO films.

1072 (CAPE–3016) **ORNL Drawing Q-6240-2 (Rev.3) and Parts List Q-6240-5 (Engineering Materials).** Kryter, R.C. Oak Ridge National Lab., TN (USA). 22 Jun 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Available from OSTI.

1 35-mm aperture card.

Copies of ORNL Drawing Q-6240-2 (Rev. 3), along with related drawings and fabrication information, were provided by me to Sammie C. Harris of the Office of Technology Applications on December 20, 1988 for his distributions to companies that have established formal licensing agreements with MMES for commercial use of Motor Current Signature Analysis (MCSA) technology developed at ORNL. This printed circuit board layout was provided to Mr. Harris in four forms: as a blueprint, a full-size negative transparency, a full-size positive transparency, and as a machine readable file on 5.25-inch flexible disk. The flexible disk, which Archer Haskins now wishes to clear for "outside" distribution, contains no ASCII text but rather a single data file (filename-Q6240-2.DRA) which can be input to a P870 printed circuit board (pcb) layout computer program to regenerate the original drawing (or a modified version thereof) in hardcopy form suitable for pcb manufacture.

1073 (LA–11633-MS) **Rf transistor thermal/electrical characterization.** Bennett, G.A.; Thompson, M.C.; Larkin, T.H.; Hedstrom, J.C. Los Alamos National Lab., NM (USA). Sep 1989. 53p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. Order Number DE90001427. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In recent years there has been a dramatic increase in semiconductor device power density and dissipated power. The typical result has been to push high-power rf transistors beyond their thermal limit because thermal time constants are much longer than the electrical ability to deposit heat. Dissipated heat removal is complicated by the desire to keep junction temperatures at a low level to maintain a predefined reliability. The purpose of our work was to improve the thermal performance of high-power rf semiconductor devices and their cooling systems. This required developing a series of numerical models to predict device thermal performance. Input for the thermal models was provided by a series of very careful electrical and thermal measurements made on several single transistors mounted in a single-stage amplifier test bed and on a large multistage amplifier. The models were validated using electrical and thermal experimental data taken during the testing. With an accurate quantity for dissipated power and an accurate surface temperature measurement in the radar and transient modes, appropriate thermal resistances were determined. We have determined that transient, or pulse sampling, is a more accurate electrical performance measurement technique than the conventional bench test methods. It provides accurate power dissipated quantities, does not cause underestimates in the average or peak junction temperatures, and does not lead to underestimating the required size of the cooling system. 35 refs., 35 figs., 7 tabs.

1074 (SAND–88-1377) **Characterization and development report for the SA3259: An operational amplifier.** McKenney, J.E. Sandia National Labs., Albuquerque, NM (USA). 29 Aug 1989. 153p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90000897. Available from NTIS, PC A07/MF A01 - OSTI.

The SA3259 is a monolithic, dielectrically isolated, junction field effect transistor (JFET) input, radiation hardened, operational amplifier. The amplifier uses a well matched high voltage bi-FET technology. Using the JFET input, input bias currents are reduced virtually to zero, initially and after thermal or radiation stress. 37 figs., 3 tabs.

1075 (SAND–89-0497) **TA705 Data Retention Chassis operating manual.** Baker, E.D. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 75p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90001886. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Data Retention Chassis (DRC) is a data acquisition component based on the Motorola 68000 microprocessor. The purpose of the DRC is to download the correct set-up parameters into sixteen Tektronix 7912 digitizers, to verify that the digitizers retain their settings, and (once the digitizers have triggered) to load that data into the DRC battery back-up CMOS memory. The DRC also has a circuit built into it called the COMMAND LINK. With the help of the TA698 Alternate Common Equipment (ACE), the user employs this link to communicate interactively with the digitizers and the DRC. Another circuit built into the DRC is the data stream multiplexer (DSM) for high-speed data transfers.

1076 (SAND–89-0711C) **High-temperature electronics available now and plans for the future.** Thome, F.; King, D.B. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by U.S. Department of Defense. DOE Contract AC04-76DP00789. MIPR FY145-88-NO609. (CONF-891159–1: GOMAC '89: government microcircuit applications conference, Orlando, FL (USA), 7-9 Nov 1989). Order Number DE90000797. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The communities identified as having the greatest need for high-temperature electronics are the geothermal and oil well-logging industries, the automobile industry, the aircraft industry for engine control and power actuators, and the space power and space exploration scientific communities. What follows is a summary of the status of the needs by the users and the progress needed to satisfy their demands. Since military aircraft and space needs represent small quantities of devices, part of the survey was to determine the impact of R&D sponsored by the Air Force on other industries. A second workshop in June 1989 was held specifically to address the principal failure causes at high temperature. They are metallization and packaging. The 3-day workshop covered metals on silicon, GaAs, silicon carbide and diamond. Experiences with plastic, metal and glass, and ceramic packaging were presented. 1 ref.

1077 **Investigation of charge storage in InAs/AlAsSb quantum well capacitors.** Lott, J.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5000 (US)); Dawson, L.R.; Weaver, H.T.; Zipperian, T.E.; Caldwell, R.B. *Applied Physics Letters (USA)*, 55(11): 1118-1120 (11 Sep 1989). DOE Contract AC04-76DP00789.

We report the electrical chracterization of an InAs/AlAsSb quantum well heterostructure capacitor fabricated on material grown by molecular beam epitaxy. Hysteresis associated with electron storage was observed in the capacitance-voltage data from which we derived exponential charge decay constants of 50 s at 77 K.

1078 **Optical fiber sensor technique for strain measurement.** Butler, M.A.; Ginley, D.S. To Dept. of Energy, Washington, DC. USA Patent 4,841,778. 27 Jun 1989. Filed date 21 Jan 1988. Int. Cl. G01L 1/24. 14p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

Laser light from a common source is split and conveyed through two similar optical fibers and emitted at their respective ends to form an interference pattern, one of the optical fibers having a portion thereof subjected to a strain. Changes in the strain cause changes in the optical path length of the strain fiber, and generate corresponding changes in the interference pattern. The interference pattern is received and transduced into signals representative of fringe shifts corresponding to changes in the strain experienced by the strained one of the optical fibers. These signals are then processed to evaluate strain as a function of time, typical examples of the application of the apparatus including electrodeposition of a metallic film on a conductive surface provided on the outside of the optical fiber being strained, so that strains generated in the optical fiber during the course of the electrodeposition are measurable as a function of time. In one aspect of the invention, signals relating to the fringe shift are stored for subsequent processing and analysis, whereas in another aspect of the invention the signals are processed for real-time display of the strain changes under study.

1079 **Shaft adjuster.** Harry, H.H. To Dept. of Energy, Washington, DC. USA Patent 4,841,621. 20 Jun 1989. Filed date 11 Mar 1988. Int. Cl. B23Q 3/18. 4p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an apparatus and method for the adjustment and alignment of shafts in high power devices. Adjacent rotatable angled cylinders are positioned between a base and the shaft to be aligned which when rotated introduce an axial offset. The apparatus is electrically conductive and constructed of a structurally rigid material. The angled cylinders allow the shaft such as the center conductor in a pulse line machine to be offset in any desired alignment position within the range of the apparatus.

1080 **Position, rotation, and intensity invariant recognizing method.** Ochoa, E.; Schils, G.F.; Sweeney, D.W. To Dept. of Energy, Washington, DC. USA Patent 4,838,644. 13 Jun 1989. Filed date 15 Sep 1987. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method is described for recognizing the presence of a particular target in a field of view which is target position, rotation, and intensity invariant includes the preparing of a target-specific invariant filter from a combination of all eigen-modes of a pattern of the particular target. Coherent radiation from the field of view is then imaged into an optical correlator in which the invariant filter is located. The invariant filter is rotated in the frequency plant of the optical correlator in order to produce a constant-amplitude rotational response in a correlation output plane when the particular target is present in the field of view. Any constant response is thus detected in the output plane to determine whether a particular target is present in the field of view. Preferably, a temporal pattern is imaged in the output plane with an optical detector having a plurality of pixels and a correlation coefficient for each pixel is determined by accumulating the intensity and intensity-squared of each pixel. The orbiting of the constant response caused by the filter rotation is also preferably eliminated either by the use of two orthogonal mirrors pivoted correspondingly to the rotation of the filter or the attaching of a refracting wedge to the filter to remove the offset angle. Preferably, detection of the temporal pattern in the output plane is performed at a plurality of arbitrary angles with angular separation sufficient to decorrelate successive frames.

4209 Waste Processing Plants and Equipment

Refer also to citation(s) 729

1081 **Municipal waste processing apparatus.** Mayberry, J.L. To Dept. of Energy, Washington, DC. USA Patent 4,778,116. 18 Oct 1988. Filed date 15 Jan 1987. Int. Cl. B02C 21/00. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an apparatus for processing municipal waste, the waste including ferrous materials, nonferrous noncombustible materials and combustible materials comprising: means for crushing most of the nonferrous noncombustible waste materials into noncombustible pieces which are smaller than a first size in which no dimension is greater than a selected length, and crushing most of the combustible materials into combustible pieces which are larger than the first size in at least some dimensions, at least some dimensions of the combustible pieces being greater than the selected length means for removing substantially all of the noncombustible pieces from the waste material; the means for removing the noncombustible pieces including a mesh screen conveyor having a plurality of openings that are large enough to pass only the pieces which are smaller than the first size without passing the pieces which are larger than the first size; and means for vibrating the conveyor comprising a plurality of rotating cams rotatably secured underneath and adjacent to each side of the conveyor belt, means for removing the pieces which pass through the openings, and

means for transporting the pieces which are larger than the first size to the collection means.

4210 Combustion Systems

Refer also to citation(s) 32, 34, 35, 312, 699, 756, 829, 977

1082 (AGARD-CP–449, pp. 7) **Damage tolerance concepts for advanced materials and engines.** Farmer, T.E.; Vanwanderham, M.C. Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Mar 1989. (CONF-8810192–: 72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion, Bath (UK), 3-5 Oct 1988). In *Application of Advanced Material for Turbomachinery and Rocket Propulsion.* Available from NTIS, PC A13/MF A01.

Planned increases in thrust to weight for future gas turbine engines require dramatically higher operating temperatures and rotor speeds. This necessitates simpler design, improved materials and sophisticated fabrication techniques. Damage Tolerance Design (DTD) has been established as the basis for gas turbine engine design and maintenance in the U.S. Consideration of damage tolerance has significant influence on configurations and materials. The advanced configurations, bonded structures, composites, anisotropic alloys and less ductile materials required to meet the advanced engine goals challenge the current DTD philosophy. Fortunately, interim plans for incremental increases in performance and engine configuration to meet long-term goals afford the opportunities for developing transition technologies to meet these objectives.

1083 (N–89-24433) **Turbine rotor/stator flowfield analysis.** Griffin, L. Lockheed Missiles and Space Co., Huntsville, AL (USA). Mar 1989. 37p. (NASA-CR–183639;NAS–1.26:183639;LMSC-HEC-TR-F–268519). Available from NTIS, PC A03/MF A01.

A numerical study of the unsteady aerodynamic and thermal environment associated with axial turbine stages is presented. Computations are performed using a modification of the ROTOR1 rotor/stator interaction code. Two different turbine states are analyzed: the first state of the United Technologies Research Center large scale rotating rig and the first state of the Space Shuttle main engine (SSME) high pressure fuel turbopump. Time-averaged blade midspan pressure and heat transfer profiles are calculated using the following different surface boundary conditions: adiabatic wall, prescribed wall temperature, and prescribed heat flux. Numerical solutions for the large scale rotating rig are compared with experimental data. Unsteady pressure envelopes are also presented for each geometry. In addition, instantaneous contours are plotted for the SSME configuration.

1084 (N–89-25490) **Advanced methods for 3-D inelastic structural analysis for hot engine structures.** Chamis, C.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jul 1989. 12p. (NASA-TM–102106;E–4873;NAS–1.15:102106;CONF-8906228–: 2. national congress on mechanics, Athens (Greece), 29 Jun - 1 jul 1989). Available from NTIS, PC A03/MF A01.

Three-dimensional Inelastic Analysis Methods are described. These methods were incorporated into a series of new computer codes embodying a progression of mathematical models (mechanics of materials, specialty finite element, boundary element) for streamlined analysis of hot engine structures such as: (1) combustor liners, (2) turbine blades, and (3) turbine vanes. These models address the effects of high temperatures and thermal/mechanical loadings on the local (stress/strain) and global (displacements, frequencies, amplitudes, buckling) structural behavior of the three respective components. The methods and the three computer codes, referred to as MOMM (Mechanics Of Materials Model), MHOST (MARC-Hot Section Technology), and BEST3D (Boundary Element Stress Technology), have been developed and are briefly described.

1085 (UBA-FB–81-125) **Development and testing of a staged-mixing burner with injection of additives for the simultaneous reduction of SO_2 and NO_x emissions in coal and oil firing systems.** Chughtai, M.Y. Steinmueller (L.U.C.) G.m.b.H., Gummersbach (Germany, F.R.). Fachbereich Forschung und Entwicklung; Umweltbundesamt, Berlin (Germany, F.R.). May 1981. 122p. (In German). Contract UFOPLAN-Nr. 10403505/03. Available from Copy held by UB/TIB Hannover.

Object of the experiments was direct desulfurisation by injection of sorbents into the flame, and the establishment of principles for further experiments in a large-scale utility boiler. A staged mixing burner was modified to use the Steinmueller Direct Desulfurisation Process 'DEP' in these experiments, and was tested under conditions simulating those in the furnace area of a watertube boiler. Fuels used were natural gas, black coal and heavy fuel oil. Various additives such as $CA(OH)_2$, $CaCO_3$ and activated $Ca(OH)_2$ were blown into the furnace in the form of fine powder, and major aspects investigated were the influence of the additive mass flow, point of injection, distribution and velocity of combustion air, and furnace temperature on the desulfurisation process. It was concluded that, given the right choice of additive and point of injection, an adequate reduction of SO_2 emissions could be achieved. When burning coal and heavy fuel oil in a staged-mixing burner, a 50% reduction of NO_x and SO_x can be achieved with a molar ratio of Ca/S = 2. The cost analysis for a large public utility boiler demonstrated the advantages of the Steinmueller 'DEP' as compared with FGD under certain operating conditions. The results achieved suggest it would be advantageous to carry out further experiments in a large power station. (orig.) With 13 refs., 8 tabs., 85 figs.

1086 **On the erosion of heat exchanger tube banks in fluidized bed combustors.** Bouillard, J.X. (Argonne National Lab., Argonne, IL (US)); Lyczkowski, R.W. pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

Heat transfer from a gas fluidized bed of solids to the surfaces of heat exchanger tube banks immersed in the bed is recognized as being one of the most attractive features of atmospheric and pressurized fluidized bed combustors (AFBC and PFBC). Unfortunately, erosion of such tube banks by vigorous solids scouring sometimes plague their operation and must be overcome to guarantee reasonable lifetimes to these commercial FBC units. Since it is generally agreed that the solids move with the rising bubbles, a simple mechanistic erosion model is derived by assessing the solids phase kinetic energy dissipated near the tubes in one layer of particles which is converted into erosion. An electrical analogy in which the solids flow (intensity) combined with the tube bank resistance to solids motion gives rise to a Joulean energy dissipation, thereafter converted into erosion rates, is presented and discussed.

1087 **Spectral analysis of dynamics in fluidized bed tube banks.** Chang, S.L. (Argonne National Lab., Argonne, IL (US)); Lyczkowski, R.W.; Berry, G.F. pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

The advancement of fluidized bed combustors, which has attracted intense commercial interest for burning high-sulfur coal economically and in an environmentally acceptable manner, has been impeded by severe erosion on the tubes. To understand the erosion through the bubble motion, Argonne National Laboratory (ANL) has developed a methodology to predict local erosion rates in a two-dimensional fluidized bed by coupling the hydrodynamic and the erosion models. Erosion models such as the monolayer energy dissipation model and several others have been used to compute the local erosion rates using as inputs the results of the hydrodynamic computer modeling. Power spectral methods are being used to develop correlations between the computed erosion rates and patterns, and the amplitude of fluctuations and cross-correlations of pressure, voidage, and gas and solids velocities. The purpose of this paper is to discuss the power spectral analyses of bed dynamics and erosion in fluidized bed tube arrays. The effects of jet velocity on the bed dynamics are studied.

1088 **Computation of dynamics and erosion for small tube arrays in fluidized beds.** Lyczkowski, R.W. (Argonne National

Lab., Argonne, IL (US)); Folga, S.; Chang, S.L.; Bouillard, J.X. pp. 181 of The 5th Miami international symposium on multi-phase transport and particulate phenomena (Condensed Papers). Veziroglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-881202–: 5. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL (USA), 12-14 Dec 1988).

The erosion issue in both atmospheric and pressurized fluidized bed combustors (AFBC's and PFBC's) has received increased attention in the last several years. The problem of erosion (more generally referred to as metal wastage) is so severe that in some cases the lifetime of tubes is as little as several thousand hours. The problem is international in scope and is hampering the commercialization of AFBC's and PFBC's for burning coal in a clean manner. The purpose of this paper is to discuss Argonne National Laboratory's (ANL's) current state-of-the-art computational capabilities for bed dynamics and erosion in fluidized bed tube arrays. Hydrodynamic calculations were performed for generic few-tube approximations of the Coal Research Establishment's cold model erosion experiment, located in Great Britain, as well as for single round and square tubes. These computations have been analyzed with a view toward explaining the erosion rates and patterns computed by the erosion models. The ANL monolayers energy dissipation erosion model is developed. Details of ANL's generalization of the classical Finnie impaction erosion model are given.

4220 Underground Engineering

Refer also to citation(s) 308, 1233

4230 Marine Engineering

1089 (CRIE-U–88023) **Behaviors and scale effect of wave reflection and run-up on armored breakwater.** Sakakiyama, Tsutomu; Saito, Shozo. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Sep 1988. 47p. (In Japanese). Order Number DE89901293. Available from NTIS (US Sales Only), PC A03/MF A01.

In order to elucidate wave reflections and run-up heights on armored breakwaters a large number of which are employed for seaside thermal power plants, large scale hydraulic experiments were performed in a large wave flume of 205m long, 3.4m wide and 6.0m deep using three kinds of armour units now used frequently. Following the Froude law for scaling, a series of experiments was also conducted using five kinds of model sizes in order to investigate the scale effects on the wave reflectional coefficient and wave run-up height. The behaviors of the wave reflection and run-up obtained by the large scale experiments were qualitatively similar to the results by the small scale experiments. However, the differences in quantity were recognized through the comparison between the results of the large and small scale experiments. It is explained that the scale effect on the wave reflection is equivalent to the relationship between friction factor and Reynolds number with a parameter of the roughness. Modeling the mechanism of energy extinction on the armoured breakwater the experimental formula to estimate the reflectional coefficient was proposed and the diagrams were presented for various incident waves, such as wave length and wave heights, and porosities of the amour layer of the breakwater. 24 refs., 26 figs., 2 tabs.

4240 Pollution Control Equipment

Refer also to citation(s) 312, 1251

43 PARTICLE ACCELERATORS

Refer also to citation(s) 1395

4301 Design, Development, and Operation

1090 (CONF-8905190–1) **Operational experience of the ATLAS accelerator.** Den Hartog, P.K.; Bogaty, J.M.; Bollinger, L.M.; Clifft, B.E.; Craig, S.L.; Harden, R.E.; Markovich, P.; Munson, F.H.; Nixon, J.M.; Pardo, R.C. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 5. international conference on electrostatic accelerators and associated boosters; Heidelberg (Germany, F.R.); 24-30 May 1989. Order Number DE90002197. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The ATLAS accelerator consists of a HVEC model FN tandem accelerator injecting into a linac of independently-phased niobium superconducting resonators. The accelerator provides beams with masses from $6 \leq A \leq 127$ and with energies ranging up to 20 MeV/A for the lightest ions and 4 MeV/A for the heaviest ions. Portions of the linac have been in operation since 1978 and, over the last decade, more than 35,000 hours of operating experience have been accumulated. The long-term stability of niobium resonators, and their feasibility for use in heavy-ion accelerators is now well established. 11 refs., 3 figs., 1 tab.

1091 (DOE/ER–0392) **SSC [Superconducting Super Collider] site evaluations.** USDOE Office of Energy Research, Washington, DC (USA). Nov 1988. 113p. Sponsored by U.S. DOE Energy Research. Order Number DE90002239. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

With this report, the SSC Site Task Force forwards to the Director, Office of Energy Research, US Department of Energy (DOE), its evaluation of the technical criteria and life-cycle costs for the proposed SSC sites judged to be the best qualified. The criteria against which each site was evaluated are those set forth in the Invitation for Site Proposals for the Superconducting Super Collider (DOE/ER-0315) (Invitation) which was prepared by the Task Force and issued in April 1987. The methodology followed by the Task Force in this report and in all other phases of the proposal evaluation has been consistent with the SSC site selection process approved by DOE's Energy System Acquisition Advisory Board (ESAAB). The goal of the site selection process is to identify a site that will permit the highest level of research productivity and overall effectiveness of the SSC at a reasonable cost of construction and operation and with minimial impact on the environment. The Task Force acknowledges that all seven sites are, indeed, highly qualified locations for the construction and operation of the SSC on the basis of technical and cost considerations. In performing its evaluation, which is presented in this paper, the Task Force took an in-depth look at each site on the basis of site visits and extensive technical analyses. A consensus rating for each technical evaluation criterion and subcriterion was developed for each site.

1092 (DOE/FTR–90001697) **[High energy accelerators]: Foreign trip report, August 19, 1989–August 31, 1989.** Courant, E.D. Brookhaven National Lab., Upton, NY (USA). 19 Sep 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001697. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the conference, many papers were presented on all aspects of accelerator work going on in all parts of the world. The highlights included reports of the first operation of LEP and SLC, and descriptions of plans and design studies for linear colliders and for TeV proton colliders.

1093 (DOE/FTR–90001698) **[Progresses and status of the AGS booster project]: Foreign trip report, August 9, 1989–August 27, 1989.** Weng, W.T. Brookhaven National Lab., Upton, NY (USA). 18 Sep 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001698. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To attend the XIV International Conference on High Energy Accelerators at Tsukuba, Japan, to give a presentation titled "Progresses and Status of the AGS Booster Project," and to attend the "Workshop on Magnetic Measurement" at SRRC, Taiwan.

1094 (JINR-E–9-89-324) **The present status of the U-400 isochronous cyclotron.** Gikal, B.N.; Gulbekyan, G.G.; Kutner, V.B. Joint Inst. for Nuclear Research, Dubna (USSR). 1989. 7p. (CONF-890560–3: 12. international conference on cyclotrons and their applications, Berlin (Germany, F.R.), 8-12 May 1989). Order Number DE90000715. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The first beam was obtained at the isochronous cyclotron U-400 10 years ago. In 1988 the accelerator was in operation for 5200 hrs, 3650 hrs of them was used for irradiation of targets. Until presently, the ions of elements from ^{10}B to ^{132}Xe with the mass-to-change ratio of 5-12 have been accelerated at the cyclotron. The cyclotron is capable of irradiating physical targets both inside the accelerator chamber and in 12 external channels positioned at 3 levels. Ion beam extraction is performed via charge exchange on stripping foils. Energy of the ions and intensity of the external beam depend on the ions type, they are in the range: E=3 20 MeV/nucl, $I=1.5 \cdot 10^{9}–1.5 \cdot 10^{13}$. 6 refs., 7 figs., 2 tabs.

1095 (LA-UR–89-3111) **The accelerator automation application toolkit workshop presentations.** Howell, J.A.; Bjorklund, E.A.; Clout, P.N.; Dalesio, L.R.; Kozubal, A.J.; Mottershead, C.T.; Rothrock, R.B.; Schaller, S.C.; Stuewe, R.B.; Westervelt, R.T. Los Alamos National Lab., NM (USA). [1988]. 55p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-8810431–: Accelerator automation application toolkit workshop, Los Alamos, NM (USA), 31 Oct - 4 nov 1988). Order Number DE90001831. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Over the past 18 months on the GTA project at Los Alamos, we have been developing tools for building control systems for accelerators. The first tool developed has already demonstrated greatly reduced requirements for conventional computer programming in applying control systems to an accelerator. Even in the early stages, this work has received considerable attention and the system is currently being investigated or used at several other institutes. Further tools are either in the conceptual design, design, or implementation phase. Over the same period, a group at CERN has been developing the ideas and design for a generic software kit for the application of a control system to accelerators. The CERN software kit also addresses the technical management and documentation aspects of control systems. The purpose of the AT Division effort and the CERN kit is to greatly simplify the implementation and lifetime maintenance of an accelerator control system. Experience has shown that accelerator control systems are also applicable to other experimental physics machines. The purpose of the workshop was to explore these ideas and developments as well as other relevant developments in the field, to verify the viability of the concepts, and to develop further the written specifications for some of the components of such a toolkit. We had draft specifications prepared prior to the workshop. 21 figs.

1096 (LBL–27004) **Exploratory studies, 1988.** Lawrence Berkeley Lab., CA (USA). May 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90001542. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: accelerator physics for the ALS; SSC support; machine investigations; mathematical techniques in particle dynamics; APIARY: B-factory studies; and two-beam accelerators and bright electron sources.

1097 (TRI-PP–89-63) **KAON physics.** Fearing, H.W. British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility. Jul 1989. 5p. (CONF-8905232–1: 4. workshop on perspectives in nuclear physics at intermediate energies, Trieste (Italy), 8-12 May 1989). Order Number DE90001191. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI.

Plans and prospects are described for KAON, a proposal by TRIUMF to build an advanced hadron facility or kaon factory. The machine will be a 30 GeV high intensity proton machine producing intense beams of kaons, pions, muons, antiprotons, and neutrinos. Some of the interesting physics which can be done with such a machine will be described.

1098 (ZfK–584, pp. 85) **Operation of the cyclotron U-120.** Anders, B.; Guratzsch, H. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. ZFK ROSSENDORF/cyclotrons; ZFK ROSSENDORF/operation; HARMONICS; ION SOURCES; LIFETIME; SPECIFICATIONS; STATISTICAL DATA; CYCLOTRONS; OPERATION

1099 (ZfK–584, pp. 86) **Operation of the electrostatic accelerators in 1985.** Buerger, W.; Turuc, S. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. TANDEM ELECTROSTATIC ACCELERATORS/operation; VAN DE GRAAFF ACCELERATORS/operation; ZFK ROSSENDORF/tandem electrostatic accelerators; ZFK ROSSENDORF/van de graaff accelerators; ION SOURCES; LIFETIME; SPECIFICATIONS; STATISTICAL DATA; OPERATION

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 1909

1100 (AD-A–204895/7/XAB) **Downstream ray tracing in beam-optics codes. Final report, September 1984-September 1987.** Reyes, W.B. Utah Univ., Salt Lake City, UT (USA). Dept. of Electrical Engineering. Oct 1988. 8p. (UTEC-MD–88-030). Available from NTIS, PC A02/MF A01.

Tunnel emittance growth in beams is a subtle phenomenon that requires the use of highly accurate simulation codes and methods to achieve reliable results. This report discusses use of self-consistent beam-optics codes in studies of emittance growth in very long PPM focused electron beams. A novel method by which a given problem can be accurately solved in a stairstep series downstream is presented. The deformable mesh code is used to simulate a gridded gun focused by a double period magnetic field used in a high-power coupled-cavity traveling-wave tube. Solution coupling across the boundary is presented in detail. The study also uncovered a fundamental problem with paraxial-based codes (Neuman boundary implicit) making their use unsuitable in emittance growth studies.

1101 (BNL–43322) **Rf stability, control and bunch lengthening in electron synchrotron storage rings.** Wachtel, J.M. Brookhaven National Lab., Upton, NY (USA). Sep 1989. 38p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002311. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A self-consistent theory for nonlinear longitudinal particle motion and rf cavity excitation in a high energy electron storage ring is developed. Coupled first order equations for the motion of an arbitrary number of particles and for the field in several rf cavities are given in the form used in control system theory. Stochastic quantum excitation of synchrotron motion is included, as are the effects of rf control system corrections. Results of computations for double cavity bunch lengthening are given. 11 refs., 4 figs., 1 tab.

1102 (UCID–21791-1) **Charged Particle Beam Research Program quarterly report, January–March 1989.** Lawrence Livermore National Lab., CA (USA). Jul 1989. 26p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001888. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report discusses the following topics: Beam Propagation Theory and Computations; Accelerator Theory; ATA Operations Supporting the CPB Experimental Program; Multi-Pulse Beam Propagation Experiments; Diagnostics Development and Data Handling; and Compact Accelerator Technology Development.

1103 **Automatic control of a laboratory system.** Saadatmand, K. (Grumman Corp., Bethpage, NY (USA)); Grauer, W.B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions*

on Nuclear Science (USA), 36(5): 1734-1737 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

In order to bring a laboratory experimental operation and diagnostics under computer control a CAMAC and PC based control architecture is devised. This architecture employs three 80386™ PC's. A Berkeley type negative hydrogen volume ion source was brought under remote computer control (supervisory control) employing this architecture on the way to the development of an automatic beam optimization algorithm.

1104 **Experimental studies of the laser-controlled collective ion accelerator.** Destler, W.W. (Electrical Engineering Department and Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742 (US)); Rodgers, J.; Segalov, Z. *Journal of Applied Physics (USA),* 66(7): 2894-2898 (1 Oct 1989).

Detailed experimental studies of a collective acceleration experiment in which a time-sequenced laser-generated ionization channel is used to control the propagation of an intense relativistic electron beamfront are presented. Ions trapped in the potential well at the beamfront are accelerated as the velocity of the beamfront is increased in a manner controlled by the time-dependent axial extent of the ionization channel. Beamfront propagation data for two different accelerating gradients are presented, together with results of ion acceleration studies for both gradients.

4303 Auxiliaries and Components

Refer also to citation(s) 1146, 1703, 1973, 1974, 2009

1105 (BNL–43335) **Performance of a directly water-cooled silicon crystal for use in high-power synchrotron radiation applications.** Oversluizen, T.; Stefan, P.M.; Sharma, S.; Matsushita, T.; Ishikawa, T.; Mikuni, A. Brookhaven National Lab., Upton, NY (USA). [1989]. 41p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8908170–1: 3. international conference on synchrotron radiation instrumentation, Tsukuba (Japan), 29 Aug - 2 sep 1989). Order Number DE90001548. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results of measurements made using the Multipole Wiggler at Beamline 16 of Photon Factory are reported. Double crystal rocking curves, Si(111) and Si(333) topographs, and thermal maps of the cooled crystal surface were measured at total incident power levels up to 1600 W and power densities up to 0.7 W/mm^2, for two different crystal designs. Significant crystal deformation occurred in the form of surface curvature for both designs. Finite element calculations provided a preview of the experimental results and proved very valuable in interpretation of the measurements. 16 refs., 10 figs., 5 tabs.

1106 (BNL–43346) **X-ray lithography source (SXLS) vacuum system.** Schuchman, J.C.; Aloia, J.; Hsieh, H.; Kim, T.; Pjerov, S. Brookhaven National Lab., Upton, NY (USA). [1989]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890335–264: 13. particle accelerator conference, Chicago, IL (USA), 20-23 Mar 1989). Order Number DE90002290. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In 1988 Brookhaven National Laboratory (BNL) was awarded a contract to design and construct a compact light source for x-ray lithography. This award is part of a technology transfer-to-American-industry program. The contract is for an electron storage ring designed for 690 MeV-500 ma operations. It has a racetrack configuration with a circumference to 8.5 meters. The machine is to be constructed in two phases. Phase I (200 MeV-500ma) will primarily be for low energy injection studies and will incorporate all room temperature magnets. For Phase II the two room temperature dipole magnets will be replaced with (4T) superconducting magnets and operation will be at 690 MeV. This paper describes the vacuum system for this machine. 9 refs.

1107 (BNL–43374) **Soft x-ray microscope using Fourier transform holography.** McNulty, I.; Kirz, J.; Jacobsen, C.; Anderson, E.; Howells, M.R.; Rarback, H. Brookhaven National Lab., Upton, NY (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890802–14: 7. synchrotron radiation instrumentation (SRI) national conference, Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90002291. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A Fourier transform holographic microscope with an anticipated resolution of better than 100 nm has been built. Extensive testing of the apparatus has begun. Preliminary results include the recording of interference fringes using 3.6 nm x-rays. The microscope employs a charge-coupled device (CCD) detector array of 576 x 384 elements. The system is illuminated by soft x-rays from a high brightness undulator. The reference point source is formed by a Fresnel zone plate with a finest outer zone width of 50 nm. Sufficient temporal coherence for hologram formation is obtained by a spherical grating monochromator. The x-ray hologram intensities at the recording plane are to be collected, digitized and reconstructed by computer. Data acquisition is under CAMAC control, while image display and off-line processing takes place on a VAX graphics workstation. Computational models of Fourier transform hologram synthesis, and reconstruction in the presence of noise, have demonstrated the feasibility of numerical methods in two dimensions, and that three-dimensional information is potentially recoverable. 13 refs., 3 figs.

1108 (BONN-IR–89-26) **The injection system of the stretcher ring ELSA.** Dreist, A. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1989. 71p. (in German). Order Number DE90718234. Available from NTIS (US Sales Only), PC A04/MF A01.

For the stretcher ring ELSA in the framwork of this thesis an injection system has been concipated and constructed which should allow all projected operational modes of this stretcher ring, the stretcher, the post-acceleration, and the accumulation mode. The proof could be performed that the realized concept allows all these operational modes. Furthermore it could be shown that the injection shifted from the equilibrium orbit has no disadvantageous effects on a uniform extraction and by this on a high touching ratio. In fact it is even possible to apply the decay of the coherent betatron oscillations around the equilibrium orbit, caused by injection of the incident beam shifted from the equilibrium orbit, to diagnosis purposes: By reproduction of this damping process in a simulation model statements on nonlinearities present in the ring and by this statements on the actual phase-space structure are possible. It has so been shown that the concept presented in this thesis and realized for this thesis represents a suited injection system for the stretcher ring ELSA. (orig.).

1109 (CONF-890335–262) **Vacuum chamber thermal protection for the APS [Advanced Photon Source].** Kramer, S.L.; Crosbie, E.A.; Kim, S.; Wehrle, R.; Yoon, M. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002228. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The addition of undulators and wigglers into synchrotron storage rings created new problems in terms of protecting the integrity of the ring vacuum chamber. If the photon beam from these devices were missteered into striking an inadequately cooled section of the storage ring vacuum chamber, the structural strength might be reduced sufficiently that the vacuum envelope could be penetrated, resulting in long downtime of the storage ring. The new generation of high-energy synchrotron light sources will produce photon beams of such high power density that cooling of the vacuum chamber will not prevent a potential penetration of the vacuum envelope, and other methods of preventing this occurrence will be required. Since active methods will be used to ensure that the beams are delivered to beam lines for users during normal operation, there is a need for passive protection methods during non-routine operation, such as turning on new beam lines, injection, etc., when the active systems may be disabled. In addition, the passive methods could prevent the problem from arising and provide the rapid time response necessary for the highest power beams, a property that might not be easily and reliably provided by active methods during the early operation of

these machines. This paper summarizes the results of a task group that studied the problem and outlines passive methods of protection for the Advanced Photon Source (APS). 2 refs., 3 figs., 1 tab.

1110 (CONF-890335–263) **Status report on the radio frequency accelerating system of the APS [Advanced Photon Source] at Argonne.** Nicholls, G.; Bridges, J.; Cook, J.; Kustom, R. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002242. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Argonne National Laboratory is designing a 7-GeV Advanced Photon Source (APS). The rf systems of the APS include 10-MHz and 120-MHz systems for the Positron Accumulator Ring (PAR), a multicell 352-MHz system for the booster synchrotron, and a system of mode-damped, single-cell 352-MHz cavities for the storage ring. The paper will describe the design of the PAR cavities, the configuration of the booster system, test results of the junction circulator developed for the cavities, and results of the higher-order mode damping as applied to the storage ring cavities. 10 refs., 1 fig., 2 tabs.

1111 (CONF-890335–270) **Status of superconducting rf cavity development.** Shepard, K.W. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002253. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The scope of accelerator applications of rf superconducting devices is briefly discussed from a historical perspective. Current projects and development activity are outlined. 56 refs., 4 figs.

1112 (CONF-890703–20) **Operating experience with the Argonne PIIECR ion source system.** Pardo, R.C.; Billquist, P.J. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on ion sources; Berkeley, CA (USA); 10-14 Jul 1989. Order Number DE90002189. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Argonne PIIECR ion source is the first ECR in source system to operate on a high voltage (350 kV) platform. The system is the injector into a new superconducting linac which will eventually provide beams over the entire periodic table, including uranium. The experience we have had with the system to date will be discussed. Emphasis will be placed on the source performance with solid materials and the initial performance of the system as an injector to the superconducting linac. The bunching system which is part of the overall source system allows a determination of the system longitudinal emittance. Results of these initial measurements will be presented. 4 refs., 2 figs., 1 tab.

1113 (CONF-891055–1) **Design features of an axial-geometry, plasma-sputter, heavy negative ion source.** Alton, G.D. Oak Ridge National Lab., TN (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on the production and neutralization of negative ions and beams; Upton, NY (USA); 30 Oct - 3 nov 1989. Order Number DE90002476. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An axial-geometry, plasma-sputter, negative ion source, which utilizes multi-cusp, magnetic-field, plasma-confinement techniques, is under design at the Oak Ridge National Laboratory (ORNL). The source is based on the principles of operation used in a recently developed radial-geometry source which has demonstrated pulsed-mode peak intensity levels of several mA for a wide spectrum of heavy negative ion species. The pulsed-mode characteristics of the source are well suited for tandem electrostatic accelerator/synchrotron injection applications. Mechanical design features include provisions for fast interchange of sputter samples, ease of maintenance, direct cooling of the discharge chamber, and the use of easily replaced coaxial LaB_6 cathodes. Principal features of the source will be described and the results of computational studies of the ion extraction optics will be presented. 15 refs., 5 figs., 1 tab.

1114 (CONF-8810432–1) **Gigatron, a new technology for microwave power devices.** McIntyre, P.M.; Elliott, S.M.; Gray, H.; Lee, B.; Pang, Yaoqi; Popovic, M.B. Texas A and M Univ., College Station, TX (USA). Dept. of Physics. 1988. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-85ER40236. From SPIE symposium of high power microwave devices; Los Angeles, CA (USA); Oct 1988. Order Number DE90001066. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The gigatron is a new design concept for microwave power devices. A gated field-emitter array is employed to produce microwave-modulated electron beam directly from the cathode. A ribbon beam configuration is used to mitigate space-change effects and provide efficient output coupling. A traveling wave output coupler is used to obtain optimum coupling to a wide beam. Rf conversion efficiency is estimated at ~75%. Gigatron-family devices have been designed for applications from 3 GHz to 60 GHz frequency, from 30 W microtubes for phased-array antenna drivers to 500 MW drivers for linac colliders. 5 refs., 4 figs., 2 tabs.

1115 (CONF-8908145–3) **Status of RF superconductivity at Argonne.** Shepard, K.W. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 4. workshop on RF superconductivity; Ibaraki-Ken (Japan); 14-18 Aug 1989. Order Number DE90002173. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Development of a superconducting (SC) slow-wave structures began at Argonne National Laboratory (ANL) in 1971, and led to the first SC heavy-ion linac (ATLAS - the Argonne Tandem-Linac Accelerating System), which began regularly scheduled operation in 1978. To date, more than 40,000 hours of bean-on target operating time has been accumulated with ATLAS. The Physics Division at ANL has continued to develop SC RF technology for accelerating heavy-ions, with the result that the SC linac has, up to the present, has been in an almost continuous process of upgrade and expansion. It should be noted that this has been accomplished while at the same time maintaining a vigorous operating schedule in support of the nuclear and atomic physics research programs of the division. In 1987, the Engineering Physics Division at ANL began development of SC RF components for the acceleration of high-brightness proton and deuterium beams. This work has included the evaluation of RF properties of high-T_c oxide superconductors, both for the above and for other applications. The two divisions collaborated while they worked on several applications of RF SC, and also worked to develop the technology generally. 11 refs., 6 figs.

1116 (DOE/FTR–90001288) **[The AGS Booster Vacuum Systems]: Foreign trip report, September 23, 1989–October 4, 1989.** Hseuh, H.C. Brookhaven National Lab., Upton, NY (USA). 23 Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001288. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report contains information on accelerator vacuum systems as they are related to AGS Booster project and RHIC project.

1117 (DOE/FTR–90001289) **[Superconducting magnet test facilities at CERN [European Organization for Nuclear Research] and modifications to the cryogenic system for the AGS Experiment 840]: Foreign trip report, September 21, 1989–September 24, 1989.** Prodell, A.G. Brookhaven National Lab., Upton, NY (USA). 12 Oct 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001289. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The superconducting magnet test facility at CERN has the capability of testing magnets in a vertical cryostat at temperatures as low as 1.8K to currents as high as 20 kA. Helium refrigerator systems are also located in experimental areas for special use superconducting magnets. Proposed modifications to the cryogenic system for AGS Experiment 840 were explored.

1118 (DOE/FTR–90001290) **[Testing superconducting magnets for the HERA project]: Foreign trip report, September 16–September 24, 1989.** Prodell, A.G.; Cozzolino, J.; Rogers, E. Brookhaven National Lab., Upton, NY (USA). 5 Oct 1989. 8p.

Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001290. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To observe the facility at DESY being used to test superconducting magnets for the HERA Project.

1119 (DOE/FTR–90001291) **[Production of coils for magnets of European colliders]: Foreign trip report, September 25, 1989–September 27, 1989.** Elisman, Y.L. Brookhaven National Lab., Upton, NY (USA). 11 Oct 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001291. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A trip report outlines impressions and information received while observing coil winding and curing fixtures during one-day stay at Ansaldo Componenti Factory.

1120 (DOE/FTR–90001705) **[Advanced acceleration]: Foreign trip report, August 16–26, 1989.** Palmer, R.B. Brookhaven National Lab., Upton, NY (USA). 28 Sep 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001705. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

I attended the ICFA meeting on Aug. 18 at KEK, as chairman of the Panel for Advanced Acceleration Mechanisms and Technologies. On Aug. 22–26 I attended the 14th International Conference on High Energy Accelerators, at Tsukuba, Japan, and gave a short presentation and a poster paper. During the meeting on Aug. 24, I visited the high gradient test facility and rf labs at KEK, and had discussions with members of that team.

1121 (DOE/FTR–90001706) **[Shipment of Booster Dipole Vacuum Chambers]: Foreign trip report, August 28, 1989–September 10, 1989.** Guilmette, J. Brookhaven National Lab., Upton, NY (USA). 26 Sep 1989. 45p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001706. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective of the trip was to resolve problems which were delaying shipment of Booster Dipole Vacuum Chambers from E. Zanon Spa, under terms of BNL purchase order No. 311177. A follow up visit to CERN was intended to obtain additional technical information relating to the Booster design, CERN's experience with Zanon and discussion on any additional problems associated with their liaison effort in conjunction with this project.

1122 (FNAL-TM–1617) **Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 1, Instrumentation and experimental preparation (300K–80K).** Boroski, W.N.; Gonczy, J.D.; Niemann, R.C. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890701–12: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90001873. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Thermal performance measurements of a 100 percent polyester multilayer insulation (MLI) system for the Superconducting Super Collider (SSC) were conducted in a Heat Leak Test Facility (HLTF) under three experimental test arrangements. Each experiment measured the thermal performance of a 32-layer MLI blanket instrumented with twenty foil sensors to measure interstitial layer temperatures. Heat leak values and sensor temperatures were monitored during transient and steady state conditions under both design and degraded insulating vacuums. Heat leak values were measured using a heatmeter. MLI interstitial layer temperatures were measured using Cryogenic Linear Temperature Sensors (CLTS). Platinum resistors monitored system temperatures. High vacuum was measured using ion gauges; degraded vacuum employed thermocouple gauges. A four-wire system monitored instrumentation sensors and calibration heaters. An on-line computerized data acquisition system recorded and processes data. This paper reports on the instrumentation and experimental preparation used in carrying out these measurements. In complement with this paper is an associate paper bearing the same title head, but with the title extension 'Part 2: Laboratory results (300K–80K). 13 refs., 7 figs.

1123 (FNAL-TM–1618) **Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 2, Laboratory results (300K–80K).** Gonczy, J.D.; Boroski, W.N.; Niemann, R.C. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890701–17: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90001877. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The plastic materials used in the multilayer insulation (MLI) blankets of the superconducting magnets of the Superconducting Super Collider (SSC) are comprised entirely of polyesters. This paper reports on tests conducted in three separate experimental blanket arrangements. The tests explore the thermal performance of two candidate blanket joint configurations each employing a variation of a stepped-butted joint nested between sewn blanket seams. The results from the joint configurations are compared to measurements made describing the thermal performance of the basic blanket materials as tested in an ideal joint configuration. Twenty foil sensors were incorporated within each test blanket to measure interstitial layer and joint layer temperatures. Heat flux and thermal gradients are reported for high and degraded insulating vacuums, and during transient and steady state conditions. In complement with this paper is an associate paper bearing the same title head but with the title extension 'Part 1: Instrumentation and experimental preparation (300K-80K)'. 5 refs., 8 figs., 2 tabs.

1124 (FNAL-TM–1619) **A blanket design, apparatus, and fabrication techniques for the mass production of multilayer insulation blankets for the Superconducting Super Collider.** Gonczy, J.D.; Boroski, W.N.; Niemann, R.C.; Otavka, J.G.; Ruschman, M.K.; Schoo, C.J. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890701–18: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90001876. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The multilayer insulation (MLI) system for the Superconducting Super Collider (SSC) consists of full cryostat length assemblies of aluminized polyester film fabricated in the form of blankets and installed as blankets to the 4.5K cold mass and the 20K and 80K thermal radiation shields. Approximately 40,000 MLI blankets will be required in the 10,000 cryogenic devices comprising the SSC accelerator. Each blanket is nearly 17 meters long and 1.8 meters wide. This paper reports the blanket design, an apparatus, and the fabrication method used to mass produce pre-fabricated MLI blankets. Incorporated in the blanket design are techniques which automate quality control during installation of the MLI blankets in the SSC cryostat. The apparatus and blanket fabrication method insure consistency in the mass produced blankets by providing positive control of the dimensional parameters which contribute to the thermal performance of the MLI blanket. By virtue of the fabrication process, the MLI blankets have inherent features of dimensional stability three-dimensional uniformity, controlled layer density, layer-to-layer registration, interlayer cleanliness, and interlayer material to accommodate thermal contraction differences. 11 refs., 6 figs., 1 tab.

1125 (Juel-Spez–496) **CANU workshop on polarization physics at COSY.** Eversheim, P.D.; Hinterberger, F.; Paetz genannt Schieck, H. (eds.). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY. Apr 1989. 244p. (In German). (CONF-8902146–: CANU workshop on polarization physics at COSY, Bad Honnef (Germany, F.R.), 14-15 Feb 1989). Order Number DE90718174. Available from NTIS (US Sales Only), PC A11/MF A01.

These proceedings contain the projection foils of the talks held at the named workshop. These concern general polarization physics, the polarization program at Saturne, the polarized beam at COSY, internal polarized targets, storage cell targets, a polarized ^{3}He target, polarized proton and deuteron targets at ELSA, a polarimeter in the intermediate energy range, symmetry breaking in the NN interaction, the study of parity violation in the COSY energy range, the

structure of simple and complex hadrons, intermediate-energy nuclear spectroscopy, polarization in proton reactions in the range from 130 to 500 MeV, polarized NN bremsstrahlung, polarization studies of dibaryonic resonances by means of ppreversibleπrd, and spin-isospin excitations by means of polarized deuterons and ^{6}Li. (HSI).

1126 (LA-UR–89-3534) **The development of an expert system to tune a beam line.** Schultz, D.E.; Brown, P.A. Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891094–3: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90002399. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The experience of developing an Expert System to aid in the tuning of the Ion Source Injection beam line at TRIUMF is described. The challenging and complex task of introducing Expert System technology into an established accelerator operation is outlined. Success in this environment depends strongly on the choice of project, the choice of experts, the choice of tools, and the methods used to represent the expertise. All these choices are discussed.

1127 (LA-UR–89-3596) **The development of a standard format for accelerator data analysis.** Cohen, S. Los Alamos National Lab., NM (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891094–1: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90002410. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The purpose of specifying a standard file format is to facilitate the analysis of data sampled by accelerator beam diagnostic instrumentation. The format's design needs to be flexible enough to allow storage of information from disparate diagnostic devices placed in the beam line. The goal of this project was to establish a standard file layout and syntax that can be generated and "understood" by a large set of applications running on the control and data-analysis computers at LAMPF as well as applications on personal computers. Only one file-parsing algorithm is needed for all computing systems. It is a straightforward process to code a parser for both the control computer and pc's once a consensus on the file syntax has been established. This paper describes the file format and the methods used to integrate the format into existing diagnostic and control software.

1128 (LBL–27663) **Improving the performance of power-limited transverse stochastic cooling systems.** Goldberg, D.A.; Lambertson, G.R. Lawrence Berkeley Lab., CA (USA). Aug 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890803–36: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90002329. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We present the formulas relevant to the behavior of (transverse) stochastic cooling systems which operate under the not uncommon condition that performance is limited by available output power, and contrast the operation of such systems with non-power-limited ones. In particular, we show that for power-limited systems, the two most effective improvements are the use of pickups/kickers which operate in both planes simultaneously and/or plunging of the cooling system electrodes, and present an example where increasing bandwidth is counter-productive. We apply our results to the proposed upgrade of the Fermilab $\bar{p}$ source. 4 refs., 1 fig., 2 tabs.

1129 (UCRL–101299) **A simple domain model of flux reversal in ferrites.** Avery, R.K.; DeFord, J.F.; Kamin, G.; Turner, W.C.; Zentler, J.M. Lawrence Livermore National Lab., CA (USA). 19 Sep 1989. 17p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-891117–4: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90001507. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To design ferrite core accelerator cells and pulse power sources for use in linear induction accelerators, it is necessary to know how the ferrite behaves when its magnetization reverses in times of the order of 100 ns. To meet this need, a simple model has been developed to describe fast flux reversal in soft ferrite cores. The core material is represented by an effective spherical grain whose size, shape, and orientation of crystal axes are assumed to represent averages over many grains. The magnetization mechanism considered is the collapse of an effective spherical domain within the effective grain. A magnetization equation is derived for the field needed to drive the collapsing domain wall against the viscous force of spin relaxation damping. This equation is compared with experimental data taken on small cores of TDK PE11BL which were reset by a dc field and reversed in about 150 ns. The model fits the data well over a large part of the flux reversal for a wide range of dB/dt. The values of the parameters found from fitting the data are related to the magnetic properties. Alternative domain configurations which have been investigated are also mentioned. 10 refs., 2 figs.

1130 **Test results on a CEBAF/Cornell prototype superconducting cavity fabricated by TRW.** Loer, S. (Cornell Univ., Ithaca, NY (US)); Wong, W.; Cirillo, J.; Padamsee, H. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

Large scale application of superconducting rf cavities to accelerators requires an industrial fabrication capability. Both development of sound fabrication techniques as well as particular sensitivities critical to the performance of superconducting cavities are necessary for successful technology transfer. Good results with the first cavity built with these goals in mind prove that the technology issues related to acceptable performance are understood and controllable.

1131 **Precision measurements of the SLC spectrometer magnets.** Levi, M. (Lawrence Berkeley Lab., CA (USA)); Nash, J.; Watson, S. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(2): 265-276 (1 Sep 1989).

Precision laboratory measurements have been made of the SLC spectrometer magnets. The value of the magnetic field integral, $\int B\,dl$, has been determined in the laboratory to an accuracy of $\delta \int B\,dl / \int B\,dl = +\text{-}0.7 \times 10^{-4}$. Additionally, high-precision methods of monitoring the field integral of these magnets during actual operation have been developed. With these methods the absolute value of the field integral is continuously monitored to an accuracy of $\delta \int B\,dl / \int B\,dl = +\text{-}1.0 \times 10^{-4}$. (orig.).

1132 **Expert systems tactics in testing Fastbus Segment Interconnect modules: Lessons so far in the SIDES project.** Knowles, R.N. (Fermi National Accelerator Lab., Batavia, IL (USA)); Forster, R.; Ho, N.; Kroma, J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1499-1501 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The Fastbus Segment Interconnect (SI) module is among the most complex modules to diagnose and repair. The SI, being an intermediary device, provides a temporary connection between two otherwise independent Fastbus segments. Internal SI problems typically manifest themselves elsewhere within the segments served. Off-line testing of this sophisticated device is equally challenging, and it's into this environment that Fermilab has launched an exploratory project called the SEGMENT INTERCONNECT DIAGNOSTIC EXPERT SYSTEM, (SIDES), to evaluate the technology as well as to create a more effective and streamlined testing schema. Presented here are some of the issues which have arisen during the initial phases of this project.

1133 **Software for FASTBUS and Motorola 68K based readout controllers for data acquisition.** Pordes, R. (Fermi National Accelerator Lab., Batavia, IL (USA)); Bernett, M.; Dorries, T.; Haire, M.; Moore, C.; Oleynik, G.; Votava, M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1544-1548 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Many High Energy Physics experiments at Fermilab are now including FASTBUS front-ends in their data acquisition systems. The requirements on controllers to readout and control these FASTBUS systems are increasing in complexity and speed. The Data Acquisition Software Group has designed general software for front end 68K processor boards housed in FASTBUS or VME to meet these needs. The first implementation has been developed for the General Purpose FASTBUS Master (GPM). This software is being ported to the FASTBUS Smart Crate Controller under development at Fermilab. The software is designed, using structured analysis tools and coding in C, to be easily portable in the future to new processor boards. As part of their extended support for FASTBUS, they have enhanced their software for the intelligent LeCroy 1821 FASTBUS interface and implemented the FASTBUS standard routines for the VAX/VMS operating system.

1134 **Data acquisition for FNAL E665.** Geesaman, D.F. (Argonne National Lab., IL (USA)); Green, M.C.; Kaufman, S.; Tentindo-Repond, S.; Bartlett, T.F.; Melanson, H.L.; Petravick, D.; Michael, D.G.; McLeod, D.; Vidal, M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1528-1533 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

In this paper the data acquisition system for FNAL E665, an experiment to study deep inelastic muon scattering from nucleons and nuclei, is described. The system is built with the FNAL VAXONLINE and RSX DA building blocks. The structure, capabilities and limitations for data flow, control and monitoring are discussed.

1135 **The PAN-DA data acquisition system.** Petravick, D. (Fermi National Accelerator Lab., Batavia, IL (USA)); Berg, D.; Berman, E.; Bernett, M.; Constanta-Fanourakis, P.; Dorries, T.; Haire, M.; Kaczar, K.; Mackinnon, B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1540-1543 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The Online and Data Acquisition software groups at Fermi National Accelerator Laboratory have extended the VAXONLINE data acquisition package to include a VME based data path. The resulting environment, PAN-DA, provides a high throughput for logging, filtering, formatting and selecting events. It is discussed in this paper.

1136 **Exabyte helical scan devices at Fermilab.** Constanta-Fanourakis, P. (Fermi National Accelerator Lab., Batavia, IL (USA)); Kaczar, K.; Oleynik, G.; Petravick, D.; Hockney, G.; Bracker, S.; DeMiranda, J.M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1696-1700 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Exabyte 8mm helical scan storage devices are in use at Fermilab in a number of applications. These devices have the functionality of magnetic tape, but use media which is much more economical and much more dense than conventional 9 track tape.

1137 **Computer control for a particle beam accelerator.** Laycak, J.F. Jr. (Lawrence Livermore National Lab., CA (USA)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1616-1618 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

This paper discusses a computer control system which was developed for a large particle beam accelerator. This system is composed of a series of VAX computers, programmable controllers, and graphics operator consoles. Unique to the software design is the ability to rapidly reconfigure the operator's view of the machine as well as the associated control logic used whenever a new physics experiment is implemented.

1138 **FEREAD: Front end readout software for the Fermilab PAN-DA data acquisition system.** Dorries, T. (Fermi National Accelerator Lab., Batavia, IL (USA)); Haire, M.; Moore, C.; Pordes, R.; Votava, M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1710-1714 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The FEREAD system provides a multi-tasking framework for controlling the execution of experiment specific front end readout processes. It supports initializing the front end data acquisition hardware, queueing and processing readout activation signals, cleaning up at the end of data acquisition, and transferring configuration parameters and statistical data between a "Host" computer and the readout processes. FEREAD is implemented as part of the PAN-DA software system and is designed to run on any Motorola 68κ based processor board. It has been ported to the FASTBUS General Purpose Master (GPM) interface board and the VME MVME133A processor board using the rhoSOS/Microtec environment.

1139 **Uniform communications software using TCP/IP.** Bernett, M. (Fermi National Accelerator Lab., Batavia, IL (USA)); Oleynik, G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1715-1718 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Data acquisition applications at Fermilab require a reliable, distributed communication system for downloading, diagnostics, control, and data distribution. TCP/IP over Ethernet was chosen because of its uniform user interface and commercial availability for a number of processors and operating systems. This paper describes the authors software and hardware support for TCP/IP on VAX/VMS, VME/rhoSOS, FASTBUS/rhoSOS, and Unix systems. It includes plans to provide a portable, hardware independent implementation of TCP/IP based on Berkeley BSD software.

1140 **A real time integrated environment for Motorola 680chichi-based VME and FASTBUS modules.** Berg, D. (Fermi National Accelerator Lab., Batavia, IL (USA)); Heinicke, P.; MacKinnon, B.; Nicinski, T.; Oleynik, G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1701-1705 (Oct 1989). (CONF-890545--: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The Software Components Group rhoSOS operating system kernel and rhoROBE debugger have been extended to support the Fermilab PAN-DA system for a variety of Motorola 680chichi-based VME and FASTBUS modules. These extensions include: a multitasking, reentrant implementation of Microtec (2) C/Pascal; a serial port driver for terminal I/O and data transfer; a message reporting facility; and enhanced debugging tools.

4304 Storage Rings

1141 (CONF-890335–260) **Study of collective effects in a low-emittance PEP lattice.** Kramer, S.L.; Borland, M.; Galayda, J.; Jackson, A.; Winick, H.; Zisman, M.S. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002243. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper summarizes the work on the collective effects studied during the previously described low-emittance operation of PEP. These studies looked at the single bunch and multi-bunch current limits consistent with stable beam operation. The lower than expected current limits and observed coherent beam oscillations, together with methods of countering them, were considered at a recent SSRL workshop. A result of these studies has been that the lower momentum compaction factor and large beta function variations of the low-emittance lattice (a common feature of all proposed high-energy radiation sources) contribute to enhanced collective effects, limiting the early achievable beam intensity to less than the desired 100 mA. The calculational models, especially because of the uncertainty of the beam impedance models, have limited predictability for these effects and will benefit from continued studies of this kind.

1142 (CONF-890335–261) **Impedance calculations for 2-D and 3-D structures and the impedance budget of 7-GeV APS [Advanced Photon Source] storage ring.** Chou, W.; Jin, Y. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002227. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

For the storage ring of the 7-GeV Advanced Photon Source (APS), we numerically calculate the longitudinal and the transverse coupling impedances of various kinds of two- and three-dimensional structures. It is shown that the RF cavities are the main contributors to the longitudinal impedance, whereas the transitions between the chamber and the insertion device section dominate the transverse one. Several different numerical approaches are adopted. It is argued that the broadband resonator model may not be appropriate to model the longitudinal impedance. Several interesting phenomena of general interest, including a composition rule and the negative transverse impedance, are discussed. Based on our numerical results and other results available, the impedance budget of the storage ring is established. 9 refs., 8 figs., 1 tab.

1143 (CONF-890335–265) **Emittance growth in a storage ring due to ground motion.** Chou, W. Argonne National Lab., IL (USA). [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002248. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

For a synchrotron light source designed for a small natural emittance, ground motion could lead to a non-negligible growth in emittance. When the ground motion is of the plane-wave type, one can study this dynamical process analytically by employing a method that combines the previously developed transfer function technique with a normal mode analysis that takes into account the magnification of the motion due to magnet supports. The explicit relationship between the amplitudes of the ground vibration and the emittance growth as a function of the vibration frequency is presented. Numerical examples are included. 3 refs., 3 figs., 1 tab.

1144 (CONF-890335–266) **Status of magnet power supply development for the APS [Advanced Photon Source] storage ring.** McGhee, D. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002252. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To simplify installation and speed testing of the Advanced Photon Source (APS) storage ring magnets, vacuum chambers and magnet power supplies, a modular approach was developed. All but the dipole magnets are independently controlled. Pulse width modulated dc-to-dc converters are used to power the individual magnets, with 12-pulse power supplies providing the raw dc to the converters. A magnet support base is the heart of a module and may hold as many as 7 magnets with 8 individually powered coils. The dc-to-dc converters are part of each magnet base module. This paper will show the modular approach which is used for the storage ring magnet systems and will give the test results of the prototype topology for the dc-to-dc converters that are being built and tested to power 680 quadrupole and sextupole magnets. 4 refs., 11 figs., 1 tab.

1145 (CONF-890335–268) **The positron accumulator ring for the APS.** Crosbie, E.A. Argonne National Lab., IL (USA). [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002240. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Positron Accumulator Ring (PAR) is designed to accumulate and damp positrons from the 450-MeV linac during the 0.5-s cycle time of the injector synchrotron for the APS 7-GeV storage ring. During 0.4 s of each synchrotron cycle, up to 24 linac pulses are injected into the horizontal phase space of the PAR at a 60-Hz rate. Each injected pulse occupies about 1.3 of the circumference of the accumulator ring. After 0.1 s for longitudinal damping, the single accumulated bunch is transferred to one of the 353-MHz buckets of the injector synchrotron RF system. The bunch is accelerated to 7 GeV and transferred to the storage ring, while the PAR accumulates the next bunch of positrons. 2 refs., 3 figs., 2 tabs.

1146 (DOE/ER/45384–1) **Research at and operation of the material science x-ray absorption beamline (X-11) at the National synchrotron light source: Annual progress report.** Sayers, D.E. North Carolina State Univ., Raleigh, NC (USA). [1989]. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER45384. Order Number DE90001980. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Since resuming x-ray operation in June of 1988 the NSLS x-ray ring has proven to be the most productive x-ray synchrotron radiation facility in the world. As it had before the shutdown of the x-ray ring, our PRT exploited the availability of this radiation to the extent that we operated more than 165 days from June, 1988 through the first quarter of 1989. The PRT has remained stable in the number of participating organizations but continues to increase the number of users and collaborators. It serves an important training function with more than 30 students and post-doctoral currently associated, with the PRT and 4 dissertations produced during 1988-1989 involving work done X-11. The PRT membership and a summary of student and postdoctoral associates are given in Appendices A and B, respectively. The PRT has also actively involved general users in its programs. We are continually oversubscribed by a factor of three for requests for general user time on our beamline. A list of our general users is given in Appendix C.

1147 (Juel-Spez–489) **CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich.** Turek, P. (ed.). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY. Jan 1989. 391p. (In German). (CONF-8812114–: CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, Bad Honnef (Germany, F.R.), 20-21 Dec 1988). Available from Available from Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralbibliothek.

The CANU workshop held on December 20 and 21, 1988 had two main objectives: To explain and discuss suggestions for COSY experiments whose planning and design status allowed to submit proposals or letters of intent to the COSY Programme Advisory Committee (PAC). The copies of proposals presented and collected for this volume show the rich variety and quality of suggested experiments. The discussions prepared the way for planning of collaborative work and joint efforts for detector development. The last day's discussions have shown that the university study programme set up by KFA is a primer in this context and a signpost to future activities by university study groups for developing suggested COSY experiments to the status of proposals. (orig./HP).

1148 (LA-UR–89-3560) **Emulating conventional operator interfaces on window based workstations.** Carr, G.P. Los Alamos National Lab., NM (USA). [1989]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891094–2: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90002415. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper explores an approach to initially support the LAMPF and PSR control system on VAX/VMS workstations using DECwindows and VI Corporation DataViews as the operator interface. The PSR control system was recently turned over to MP division and the two control system staffs were merged into one group. One of the goals of this new group is to develop a common work station based operator console and interface which can be used in a single control room controlling both the LINAC and Proton Storage Ring. The new console operator interface will need a high level graphics toolkit for its implementation. During the conversion to the new consoles it will also probably be necessary to write a package to emulate the current operator interfaces at the software level. This paper describes a project to evaluate the appropriateness of VI Corporation's DataViews graphics package for use in the LAMPF control system environment by using it to write an emulation of the LAMPF touch panel interface to a large LAMPF control system application program. A secondary objective of this project was to explore any

productivity increases that might be realized by using an object oriented graphics package and graphics editor. 2 refs., 6 figs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 423, 458, 969, 1125, 1344, 1406, 1726, 1805

1149 (AD-A–209720/2/XAB) **Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981.** Share, G.H.; Kurfess, J.D.; Marlow, K.W.; Eisele, J.A.; Chupp, E.L. Naval Research Lab., Washington, DC (USA). 31 May 1989. 36p. (NRL-MR–6466). Available from NTIS, PC A03/MF A01.

Revision of Rept. no. NRL-MR-4596, AD-C025 833L.

The gamma-ray experiment on board NASA's Solar Maximum Mission Satellite (SMM) has detected nuclear radiation emitted from the reactor on COSMOS 1176. Direct observations of gamma rays and possibly neutrons from this reactor were made at distances as close as about 350 km. Nuclear line features were observed in the gamma-ray spectrum. Explanations for some of these features are presented. The absolute power of the reactor is difficult to estimate at present; however, there is evidence that both the intensity and spectral shape of the emitted radiation changed significantly during the operational period of COSMOS. The reactor was also detected at distances of > or = 6,300 km in an indirect manner. Positrons and electrons escaping from the COSMOS spacecraft following production by the intense gamma-radiation are stored temporarily in the Earth's magnetic field and given an unambiguous signal due to their characteristic annihilation into gamma-rays at 511 keV. Details of these observations and their implications are discussed.

1150 (AD-A–209721/0/XAB) **Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report.** Share, G.H.; Kurfess, J.D. Naval Research Lab., Washington, DC (USA). 31 May 1989. 14p. (NRL-MR–6467). Available from NTIS, PC A03/MF A01.

Revision of Rept. No. NRL-MR-5617.

Nuclear radiation from the reactor-powered satellite COSMOS 1579 was monitored by the gamma-ray spectrometer (GRS) on NASA's Solar Maximum Mission satellite (SMM). Gamma rays from the RORSAT were detected about every 4 days as it passed within about 500 km of SMM. In addition, events attributed to positrons emitted from the outer shell of COSMOS 1579 were detected on the average of once about every 1.5 days. These positrons were detected at large distances (< or = 5000 km) from COSMOS after being stored in the earth's magnetic field for seconds or minutes. The rate of the positron detections is about a factor of two higher than observed for most of the earlier RORSAT's detected by SMM. At present, this increase is unexplained. The qualitative features of the measured gamma-ray spectrum from COSMOS 1579 are similar to those of preceding satellites; however, the spectral features are clearer. A model is presented for the origin of these features which suggests the presence of significant amounts of beryllium, sodium, potassium, molybdenum, and lithium and/or hydrogen lying with tens of gm/sq. cm of material. There is also spectral evidence for the presence of either iron or aluminum. Based on this model a conservative lower limit is obtained for to the thermal power of the reactor on COSMOS 1579. This lower limit is 30 kW.

1151 (AD-A–209722/8/XAB) **Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985.** Share, G.H.; Kurfess, J.D. Naval Research Lab., Washington, DC (USA). 31 May 1989. 31p. (NRL-MR–6468). Available from NTIS, PC A03/MF A01.

Revision of Rept. no. NRL-MR-5862.

This report provides details of SMM's observations of the seven RORSATS launched from 1980 through 1984. Estimates are obtained of the relative power of the reactors from integral gamma-ray intensities measured at distances <400 km. The average intensities from the seven satellites, after correcting for distance of separation, are consistent with each other to within 30%. In contrast, the rate of distant detections of positrons increased with time over the four-year period. The rate of detections was about 0.2/day in 1980 and 0.7/day in 1984. This increasing rate is due to the decreasing atmospheric density above a few hundred km in the transition from maximum to minimum solar activity. The positron storage time in the geomagnetic field is expected to increase with decreasing density. A composite gamma-ray spectrum created from a summation of close-approach sightings of the seven RORSATS is presented. It is not possible to obtain a unique interpretation of this spectrum. One relatively simple model of the gamma-ray spectrum emitted from the RORSATS which fits the data reasonably well includes the following components: a fission continuum from ^{235}U and neutron-capture lines from molybdenum embedded within tens of g/sq cm of material; two unresolved lines near 500 keV attributed to a line at 511 keV from positron-annihilation and to a line near 477 keV from boron.

1152 (AD-A–209723/6/XAB) **Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report.** Share, G.H.; Kurfess, J.D. Naval Research Lab., Washington, DC (USA). 31 May 1989. 23p. (NRL-MR–6469). Available from NTIS, PC A03/MF A01.

Revision of Rept. no. NRL-MR-6297.

The gamma-ray spectrometer (GRS) on NASA's Solar Maximum Mission satellite (SMM) has been monitoring Soviet nuclear reactors in space since 1980 when it detected radiation from COSMOS 1176. Direct observations of gamma radiation were made within about 500 km when the RORSATS were not occulted by a significant amount of material in SMM. Indirect observations were also made up to distances in excess of a few thousand kilometers. These observations were made when positrons and electrons produced in the outer layers of the reactor-powered spacecraft reached SMM after being stored in the Earth's magnetic field. This report provides details of SMM's observations of the four RORSATS launched in 1985 and 1986, and compares these with measurements made of the seven RORSATS detected from 1980 to 1984. The average intensities from all the eleven reactor-powered satellites are consistent with each other, after correcting for distance of separation. The observed increase in the rate of distant detections of positrons from 1980 to 1984 is due to the decreasing atmospheric density above a few hundred km in the transition from maximum to minimum solar activity. The rate did not change significantly between 1984 and 1986.

1153 (ANL-HEP-CP–89-52) **The soudan 2 experiment.** Ayres, D.S. Argonne National Lab., IL (USA). 25 May 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8904234–2: 10. and final workshop on grand unification, Chapel Hill, NC (USA), 20-22 Apr 1989). Order Number DE90002267. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Soudan 2 is an 1100-ton tracking calorimeter which is being constructed to search for nucleon decay. The detector consists of finely segmented iron instrumented with drift tubes, and records three spatial coordinates and dE/dx for every gas crossing. Excellent event-reconstruction capability, particle identification, and muon sign and direction determination give superior rejection of the neutrino background to nucleon decay in many modes. The first 275 tons of Soudan 2 is operating and a charged-particle test beam calibration is under way. Construction is scheduled for completion in 1992. 4 refs., 6 figs., 2 tabs.

1154 (BONN-IR–89-18) **Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment.** Muesch, H. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. May 1989. 51p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

A transition radiation detector is currently under construction in order to identify single electrons inside hadron-jets of deep inelastic ep-collisions at HERA. We performed measurements with test-modules in mixed particle beams, composed of electrons and pions, at the CERN-PS and -SPS. The transition radiation was generated in polypropylene fibres. The photons were detected in time expansion chambers which were dominantly filled with Xenon. The absorption of transition radiation as well as δ-electrons leads to local ionisation clusters along the track of the ionizing particle. The

amplified and shaped chamber signals were digitized by using flash ADCs in order to conserve the time structure of the signal. The tail cancellation due to pulse-shaping improves the recognition of clusters, generated close together along the primary ionisation track. The application of cluster analyzing methods leads to a better electron-pion separation. From the results of one chamber we calculated the peformance of a detector set-up consisting of four modules. Applying such algorithms we obtained a misidentifiaction of pions in the energy range from 2-10 GeV of about 1-2% at 90% electron detection efficiency. (orig.).

1155 (BONN-IR-89-19) **Development and construction of a monitoring system for the central drift chamber of the SAPHIR detector.** Gutjahr, B. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 71p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

A monitoring system built to control the central drift chamber of the detector SAPHIR at the Electron Stretcher Ring ELSA in Bonn is presented. A method to monitor the drift velocity using bremsstrahlung photons from a moderate discharge in a tube is described. This system can detect relative variations of the drift velocity smaller than 0.5% without using a radioactive source. (orig.).

1156 (BONN-IR-89-20) **Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR.** Grewe, S. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 66p. (In German). Order Number DE90718237. Available from NTIS (US Sales Only), PC A04/MF A01.

A FORTRAN program has been developed that applies a track following algorithm to group the signals coming from the central drift chamber into tracks, and that computes a first approximation of the position of these tracks at the signal wires. It is assumed that the tracks can be approximated locally by a helix. A track must have signals in at least four vertical layers and three stereo layers in order to be found. Tracks need not originate in the target, they may start after the first layer of the chamber, they may end before the last layer, and they may have one missing signal in a layer between their first layer and their last layer. The lower limit on a track's momentum is 50 MeV/c. Furthermore, an interactive graphical environment has been developed to display and manipulate single events. The program is currently running on a DEC VAX 3200 Workstation. (orig.).

1157 (BONN-IR-89-21) **Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter.** Reike, H. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 54p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The ZEUS detector for HERA features a high resolution calorimeter with depleted uranium as absorber and plastic scintillator as active medium. By means of equalizing the response of the calorimeter to hadrons and electrons of the same energy and by minimisation of systematic errors a hadronic energy resolution of $\sigma(E)/E=35\%/\sqrt{E}+2\%$ is achieved. The scintillator light is read out via wavelength shifters into photomultipliers. Uniform light distribution at the readout surface of the wavelength shifter reduces the systematic error. Investigations of the light transmission along the wavelength shifter using photodiodes has eliminated this source of error. The photomultiplier signal must be independent of the position of entrance of the scintillator light into the wavelength shifter. We describe how uniformisation to better than +-2% has been achieved for one of the wavelength shifter types in the forward calorimeter by means of individually printed reflector foils. (orig.).

1158 (BONN-IR-89-22) **Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring.** Lindemann, L. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 53p. (In German). Order Number DE90718238. Available from NTIS (US Sales Only), PC A04/MF A01.

For the offline-analysis at the Bonner SAPHIR-detector some further software tools have been developed, so that now nearly a complete offline-analysis chain is available for the reconstruction of charged particles in the SAPHIR drift chambers. This report describes the underlying concept and gives some detailed information about the approximation of the inhomogeneous magnetic field, the track reconstruction in the sideward drift chambers and the determination of the charged particle momenta. In addition the separation of pions, kaons and protons in hadronic final states by time-of-flight measurements and kinematics is discussed. (orig.).

1159 (BONN-IR-89-23) **Track recognition and track reconstruction in the forward drift chamber of SAPHIR.** Fuhrmann, R. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 51p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

A program for pattern recognition and track reconstruction of the charged particles within the forward drift chamber of SAPHIR was developed on simulated data. The efficiency for track finding and the accuracy of the reconstructed space points are discussed. Systematic errors related to the applied methods are small. (orig.).

1160 (CONF-891087-6) **Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately.** Chiles, M.M.; Bauer, M.L.; McElhaney, S.A. Oak Ridge National Lab., TN (USA). [1989]. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IEEE nuclear science symposium and exhibits; San Francisco, CA (USA); 25-27 Oct 1989. Order Number DE90001960. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This scintillation detector is composed of two scintillators optically coupled and mounted on a single photomultiplier tube. The first scintillator is a ^{6}Li-loaded glass that has high efficiency for thermal neutrons, and the second is a liquid scintillator (BC 501) that has fairly high efficiency for higher energy neutrons. The ^{6}Li glass scintillator emits light with a characteristic time constant of ~60 ns, whereas light emitted in the liquid scintillator by proton recoil from energetic neutrons has a time constant of ~30 ns and the time constant for scintillations occurring from gamma-scattered Compton electrons in the liquid scintillator is ~3.7 ns. These differences in light decay time constants make this detector conducive to electronic separation of pulses generated by the three different radiations. Thermal neutrons, high-energy neutrons, a gamma radiation can be counted separately by operating this detector with a pulse-shape discriminator recently developed. Experimental data demonstrates the proof of principle of this dual scintillator detector for many applications. 4 figs.

1161 (CONF-8909218-1) **Improved performance of low-Tc superconductors for detection of minimum-ionizing particles.** Gabutti, A.; Gray, K.E.; Wagner, R.G. Argonne National Lab., IL (USA). 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. international workshop on low temperature detectors for neutrinos and dark matter; L'Aquila (Italy); 20-23 Sep 1989. Order Number DE90001985. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Conclusive experimental evidence is presented for granular aluminum films to support the previous conjecture that practical detectors of minimum-ionizing particles (mips) will greatly benefit from, and most probably require, superconducting transition temperatures, T_c, closer to a low operating temperature. These measurements have verified the detection of a continuous spectrum of charged particles which deposit energy in a range extending up to a few times larger than mips. The important advantage of low-T_c materials is that the strips can be wider, thus avoiding the inevitable nonuniformities which become particularly bothersome in practical devices requiring lengths of order 1 cm and sub-micron widths. Our measurements indicate the same sensitivity in a 2 μm wide g-Al strip as a 0.2 μm Nb strip, and calculations confirm this. In addition, the effect of normal state resistivity, ρ_n, of the superconducting material has been established using an x-ray source. 7 refs., 6 figs.

1162 (CRIE-U–87098) **Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow.** Shimogaki, Hisashi. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Oct 1988. 26p. (In Japanese). Order Number DE89901292. Available from NTIS (US Sales Only), PC A03/MF A01.

This report studied problems applied for measuring the content of moisture in the coal ash layer by use of a neutron moisture gage, as well as a new application of this measuring device. As a result of analyzing the distribution characteristics of the thermal neutron fluxes in the sample through the neutron diffusion equation, in case of less content of moisture in the sample, the ratio of detection decreased if the measuring volume was not so large. In order to increase the ratio of detection, it is necessary to reduce the clearance between the probe and the insent pipe. As for boron, it was found that the ratio of detection significantly decreased even if the content in the sample was small because the absorption action of a thermal neutron was large. When measuring the moisture in the coal ash layer, therefore, it is necessary to draw a calibration curve which differs from that of ordinary soil. The generation of thermal neutron flux in heavy water was about 40% of light water according to analytical results. Because heavy water shows same behavior as light water, it was identified that if heavy water is poured into ground water as a tracer the flow of ground water can be fully detected with a neutron moisture gage. 7 refs., 17 figs., 4 tabs.

1163 (FNAL-TM–1616) **Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD).** Mulderink, H.; Michels, N.; Joestlein, H. Fermi National Accelerator Lab., Batavia, IL (USA). 23 Aug 1989. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90001872. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Bottom Collider Detector (BCD) has been proposed as a device to study large numbers of events containing B mesons. To identify secondary vertices in hadronic events it will employ the most ambitious silicon strip tracking detector proposed to-date. This report will discuss results from measurements on a first mechanical/thermal model of the vertex detector support structure. The model that was built and used for the studies described here is made of brass. Brass was used because it is readily available and easily assembled by soft soldering, and, for appropriate thicknesses, it will behave similarly to the beryllium that will be used in the actual detector. The trough was built to full scale with the reinforcement webbing and the cooling channels in place. There were no detector modules in place. We plan, however, to install modules in the trough in the future. The purpose of the model was to address two concerns that have arisen about the proposed structure of the detector. The first is whether or not the trough will be stable enough. The trough must be very light in weight yet have a high degree of rigidity. Because of the 3m length of the detector there is question as to the stiffness of the proposed trough. The main concern is that there will sagging or movement of the trough in the middle region. The second problem is the heat load. There will be a great deal of heat generated by the electronics attached to the detector modules. So the question arises as to whether or not the siiicon detectors can be kept cool enough so that when the actual experiment is run the readings will be valid. The heat may also induce motion by differential expansion of support components. 26 figs.

1164 (ISN–88-103) **Gas detectors for heavy ions.** Comparat, V. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. 1988. 17p. (In French). (CONF-8809411–: Joliot-Curie School on particule physics and nuclear physics instrumentation, Maubuisson (France), 26-30 Sep 1988). Order Number DE90713769. Available from NTIS (US Sales Only), PC A03/MF A01.

Review of gaseous detectors for heavy ions: scintillating streamers and ionization chambers, Bragg curve detector. Very low-pressure detectors: PPAC, MWPC and MSC.

1165 (JINR-E–10-89-362) **Some questions of using the algebraic coding theory for construction of special-purpose processors in high energy physics spectrometers.** Nikityuk, N.M. Joint Inst. for Nuclear Research, Dubna (USSR). 9 Jun 1989. 15p. (CONF-8906232–1: 7. AAECC international conference, Toulouse Cedex (France), 26 Jun 1989). Order Number DE90000714. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The results of investigations of using the algebraic coding theory for the creation of parallel encoders, majority coincidence schemes and coordinate processors for the first and second trigger levels are described. Concrete examples of calculation and structure special-purpose processor using the table arithmetic method are given for multiplicity $t \leq 5$. The question of using parallel and sequential syndrome coding methods for the registration of events with clusters is discussed. The investigation has been performed at the Laboratory of High Energies, JINR. 29 refs., 10 figs.

1166 (Juel-Conf–67) **International workshop on calorimeter simulation.** Filges, D.; Cloth, P. (eds.). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Oct 1988. 399p. (CONF-8810439–: International workshop on calorimeter simulation, Juelich (Germany, F.R.), 11-13 Oct 1988). Order Number DE90718173. Available from NTIS (US Sales Only), PC A17/MF A01.

The aim of the Juelich workshop was to provide an overview of the state of calorimeter simulation and the methods used. This resulted in 29 contributions to the following topics: Code systems relevant to calorimeter simulation, vectorization and code speed-up, simulation of calorimeter experiments, special applications of calorimeter simulation. This report presents the viewgraphs of the given talks. (orig./HSI).

1167 (LA–11659-M) **Maintenance neutron coincidence counter manual.** Krick, M.S.; Polk, P.J.; Atencio, J.D. Los Alamos National Lab., NM (USA). Sep 1989. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002510. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A compact thermal-neutron coincidence counter has been constructed specifically for use by the International Atomic Energy Agency as a reference neutron detector for maintenance activities. The counter is designed for use only with ^{252}Cf sources in SR-CF-100 capsules. This manual describes the detector's mechanical and electrical components and its operating characteristics. 2 refs., 8 figs.

1168 (LAPP-EXP–88-18) **Cryogenic detectors for particle physics.** Gonzalez-Mestres, L.; Perret-Gallix, D. Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules. Nov 1988. 22p. (CONF-8809410–: Conference on instrumentation in nuclear and particle physics, Maubuisson (France), 25-29 Sep 1988). Order Number DE90713764. Available from NTIS (US Sales Only), PC A03/MF A01.

A comprehensive introduction to cryogenic detector developments for particle physics is presented, covering conventional detectors cooled to low temperature (scintillators and semiconductors), superconductive and thermal sensitive devices, as well as the basics of cold electronics. After giving a critical overview of current work, we elaborate on possible new ways for further improvements and briefly evaluate the feasibility of the main proposed applications.

1169 (LBL–26321) **Recent advances in detectors for single-photon counting.** Leskovar, B. Lawrence Berkeley Lab., CA (USA). May 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8906230–1: LASER '89: 9th international congress on opto-electronics microwaves, Munich (Germany, F.R.), 5-9 Jun 1989). Order Number DE90001424. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The time-correlated single-photon counting method has gained wide acceptance for investigating time behaviors of the fluorescence associated with electronic energy relaxation of excited molecules, optical ranging and communication experiments, plasma diagnostics and optical time domain reflectrometry. The measurement of fluorescence lifetimes in studying the photophysical properties of organic molecules require photon detectors with high sensitivity and fast time response. The time width of the measuring system response in time-correlated single-photon counting experiments using picosecond light excitation is mainly determined by the single photoelectron time spread of photon detector. Recent

progress that has been made in fast high-gain detectors using photoemission and secondary emission processes is reviewed and summarized. Specifically, performance characteristics are presented and compared of the ITT F4129, Hamamatsu R1564U and R2287U extended lifetime microchannel plate photomultipliers. Also characteristics of the Amperex XP2020 and RCA C31024 conventionally design photomultipliers are presented. Finally, the silicon avalanche photodiodes are compared with respect to their preliminary performance in time-correlated single-photon counting applications. 21 refs., 6 figs., 1 tab.

1170 (MPI-PAE/Exp.El.–200) **Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector.** Rudowicz, M. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Hamburg Univ. (Germany, F.R.). Fachbereich Physik. Jan 1989. 133p. (In German). Available from Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

After a description of the application of the H1 detector for the study of deep inelastic ep scattering at the HERA storage ring the signal formation of electromagnetic and hadronic showers in sampling calorimeters is described. Then the concept of the shower simulation by tracking and shower parametrization is explained. Finally it is shown how a parametrized algorithm can be implemented into the shower simulation code GEANT which is applied in the simulation of the H1 detector. (HSI).

1171 (MPI-PAE/Exp.El.–208) **Development of novel semiconductor detectors for the detection of ionizing radiation.** Strueder, L. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik. Aug 1989. 159p. (In German). Order Number DE90718239. Available from NTIS (US Sales Only), PC A08/MF A01.

The present thesis treats the development of novel energy- and position-resolving semiconductor detectors: Fully depletable pn CCD's. In experiments of high-energy physics they are suited as highly resolving position-sensitive detectors for minimally ionizing particles. In nuclear and atomic physics they can be applied as position-resolving energy spectrometers. Increasing interest detectors of this type find also at synchrotron-radiation sources with photon energies from 20 eV to 50 keV. As focal instruments of X-ray telescopes they are in astrophysical measurements in an energy range from 100 eV to 15 keV of use. The required accuracy in the energy measurement amounts to 100 eV (FWHM) at an X-ray energy of 1 keV, at a simultaneous precision of the position determination of 50 μm. The measurement results which are here presented on the first fully depletable CCD's show that the components posses the potential to fulfill these requirements. (orig.).

1172 (N–89-26629) **Calibration of a photomultiplier array spectrometer.** Bailey, S.A.; Wright, C.W.; Piazza, C.R. National Aeronautics and Space Administration, Wallops Island, VA (USA). Wallops Station. Jun 1989. 8p. (NASA-TM–100739;NAS–1.15:100739). Available from NTIS, PC A02/MF A01.

A systematic approach to the calibration of a photomultiplier array spectrometer is presented. Through this approach, incident light radiance derivation is made by recognizing and tracing gain characteristics for each photomultiplier tube.

1173 (N–89-26787) **A Normal Incidence X-ray Telescope (NIXT) sounding rocket payload. Final report, 1 November 1982-31 January 1989.** Golub, L. Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory. May 1989. 15p. (NASA-CR–185438;NAS–1.26:185438). Available from NTIS, PC A03/MF A01.

Work on the High Resolution X-ray (HRX) Detector Program is described. In the laboratory and flight programs, multiple copies of a general purpose set of electronics which control the camera, signal processing and data acquisition, were constructed. A typical system consists of a phosphor convertor, image intensifier, a fiber optics coupler, a charge coupled device (CCD) readout, and a set of camera, signal processing and memory electronics. An initial rocket detector prototype camera was tested in flight and performed perfectly. An advanced prototype detector system was incorporated on another rocket flight, in which a high resolution heterojunction vidicon tube was used as the readout device for the H(alpha) telescope. The camera electronics for this tube were built in-house and included in the flight electronics. Performance of this detector system was 100 percent satisfactory. The laboratory X-ray system for operation on the ground is also described.

1174 (ORNL/FTR–3090) **[Atom probe field-ion microscopy research on silicon carbide whiskers and evaluate the position sensitive atom probe]: Foreign trip report, September 28, 1988–October 9, 1988.** Miller, M.K. Oak Ridge National Lab., TN (USA). 24 Oct 1988. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001283. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Silicon carbide whiskers were successfully analyzed with the pulsed laser atom probe. The position sensitive atom probe at Oxford University was evaluated. Fruitful discussions were held with members of the International Group on Irradiation Damage Mechanisms in Pressure Vessel Steels.

1175 (ORNL/FTR–3405) **[Data acquisition and analysis of data from highly segmented Ge gamma-ray detectors]: Foreign trip report, September 3, 1989–September 30, 1989.** Varner, R.L. Jr. Oak Ridge National Lab., TN (USA). 9 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001545. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This trip had two purposes. The first was to attend a workshop on data acquisition and analysis of data from highly segmented Ge gamma-ray detectors. The systems discussed were mainly for a detector project in Europe (Euroball), but the principles and many of the details are the same as for the proposed GAMMASPHERE detector to be built at ORNL. I also visited CERN to discuss the MICRON/MACVEE system for controlling CAMAC and VME-based electronics from a Macintosh personal computer. I discussed the system with one of the implementors and received a copy of the latest version of the development software. This software will be used at ORNL to develop small, dedicated data acquisition systems.

1176 (ZfK–584, pp. 89) **Microprocessor controlled Moessbauer spectrometer.** Reichel, P.; Matz, W.; Boede, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. MOESSBAUER SPECTROMETERS/microprocessors; MOESSBAUER SPECTROMETERS/performance testing; ABSORPTION SPECTRA; DATA PROCESSING; LINE WIDTHS; MICROPROCESSORS; SPECIFICATIONS; VELOCITY

1177 (ZfK–584, pp. 91) **Investigation of scintillation materials.** Ruediger, J. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. SCINTILLATION COUNTERS/efficiency; SCINTILLATION COUNTERS/phosphors; ALPHA PARTICLES; BARIUM FLUORIDES; BISMUTH GERMANATES; CALCIUM FLUORIDES; CALCIUM IODIDES; CERIUM COMPOUNDS; COMPARATIVE EVALUATIONS; ENERGY RESOLUTION; EUROPIUM COMPOUNDS; GAMMA RADIATION; EFFICIENCY; PHOSPHORS; SENSITIVITY; SPECIFICATIONS; THALLIUM COMPOUNDS

1178 (ZfK–584, pp. 92) **Development and test of a ΔE - E annular detector telescope.** Kleinwaechter, P.; Ruediger, J.; Doering, J.; Funke, L.; Freitag, M.; Rotter, H.; Scholz, T.; Schulze, W.; Schwengner, R.; Will, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. TELESCOPE COUNTERS/particle discrimination; TELESCOPE COUNTERS/performance testing; ALPHA PARTICLES; ALUMINIUM 27 TARGET; ANGULAR DISTRIBUTION; ANNULAR SPACE; COINCIDENCE CIRCUITS; DEUTERONS; ENERGY RESOLUTION; OXYGEN 16 REACTIONS; PROTONS; SPECIFICATIONS; TIME RESOLUTION

1179 (ZfK–584, pp. 93) **Construction of a plunger for coincidence experiments.** Winter, G.; Freitag, M.; Schulze, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. CHARGE PLUNGER METHOD/coincidence spectrometry; CHARGE PLUNGER METHOD/performance testing; COINCIDENCE SPECTROMETRY/charge plunger method; COINCIDENCE SPECTROMETRY/performance testing; ENERGY-LEVEL TRANSITIONS; GAMMA SPECTRA; KRYPTON 79; SPECIFICATIONS

1180 (ZfK–584, pp. 96) **Bragg curve ionization chamber.** Kotte, R. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. IONIZATION CHAMBERS/bragg curve; AMPLIFIERS; ELECTRODES; HEAVY ION REACTIONS; PARTICLE IDENTIFICATION; SPECIFICATIONS; SPECTROSCOPY

1181 (ZfK–584, pp. 97) **Test measurement with a Bragg ionization chamber at the Rossendorf tandem accelerator.** Kotte, R.; Ortlepp, H.G.; Keller, H.J.; Stary, F. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. IONIZATION CHAMBERS/bragg curve; IONIZATION CHAMBERS/performance testing; ALPHA PARTICLES; BROMINE 79 REACTIONS; CARBON 12 REACTIONS; CHLORINE 35 REACTIONS; ELASTIC SCATTERING; ENERGY RESOLUTION; ENERGY SPECTRA; GOLD 197 TARGET; OXYGEN 16 REACTIONS; SILICON 28 REACTIONS; SULFUR 32 REACTIONS; TANDEM ELECTROSTATIC ACCELERATORS

1182 (ZfK–584, pp. 98) **Shaping amplifier for Bragg curve spectroscopy.** Ortlepp, H.G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. IONIZATION CHAMBERS/amplifiers; IONIZATION CHAMBERS/bragg curve; AMPLIFIERS; PULSE SHAPERS; SPECIFICATIONS; SPECTROSCOPY; TIMING PROPERTIES

1183 (ZfK–584, pp. 99) **Axial ionization chamber for fragment detection.** Andronenko, L.N. (Nuclear Physics Institute, Leningard (USSR)); Janofsky, V.V.; Kotov, A.A.; Vaishnene, L.A.; Neubert, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. IONIZATION CHAMBERS/bragg curve; IONIZATION CHAMBERS/performance testing; CALIFORNIUM 252; ELECTRODES; ENERGY SPECTRA; FISSION FRAGMENTS; HEPTANE; PENTANE; SPECIFICATIONS; SPONTANEOUS FISSION

1184 (ZfK–584, pp. 88) **Converter multiwire proportional chamber (MWPC) in the multi-step avalanche mode.** Manfrass, P.; Fromm, W.D.; Sobiella, M.; Wohlfarth, D. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. MULTIWIRE PROPORTIONAL CHAMBERS/avalanche quenching; MULTIWIRE PROPORTIONAL CHAMBERS/time resolution; AMPLIFICATION; EFFICIENCY; ELECTRIC FIELDS; FOILS; HEXANE; NEON; POSITRON CAMERAS; PULSE CONVERTERS; SPECIFICATIONS

1185 (ZfK–584, pp. 94) **Double grid avalanche counter with large dynamic range.** Seidel, W.; Ortlepp, H.G.; Fiedler, J. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. RADIATION DETECTORS/avalanche quenching; RADIATION DETECTORS/time-of-flight method; ALPHA PARTICLES; AMERICIUM 241; CALIFORNIUM 252; COINCIDENCE METHODS; EFFICIENCY; FISSION FRAGMENTS; GRIDS; PENTANE; PERFORMANCE TESTING; PRESSURE DEPENDENCE; SPATIAL RESOLUTION; SPECIFICATIONS; TIME RESOLUTION

1186 (ZfK–584, pp. 95) **Timing with fast particle detectors.** Ortlepp, H.G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. RADIATION DETECTORS/avalanche quenching; RADIATION DETECTORS/timing circuits; AMPLIFIERS; ELECTRIC FILTERS; FLIP-FLOP CIRCUITS; PERFORMANCE TESTING; SPECIFICATIONS; TRIGGER CIRCUITS

1187 (ZfK–584, pp. 120) **Investigations with the aim of installation a low-level γ-spectrometer.** Kim, J.H. (Bergakademie, Freiberg (German Democratic Republic). Sektion Physik);

Unterricker, S.; Stolz, W.; Degering, D.; Hebert, D.; Simon, D. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GAMMA SPECTROMETERS/background radiation; GAMMA SPECTROMETERS/shielding; MINES/cavities; MINES/gamma spectrometers; CHEMICAL COMPOSITION; ENVIRONMENTAL MATERIALS; SHIELDING; LOW LEVEL COUNTING; MEV RANGE 01-10; MINES; CAVITIES; NATURAL RADIOACTIVITY; POTASSIUM; RADON; SALT CAVERNS; THICKNESS; THORIUM; URANIUM

1188 (ZfK–584, pp. 101) **Preamplifier for silicon particle detectors.** Ortlepp, H.G.; Schuster, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. SI SEMICONDUCTOR DETECTORS/preamplifiers; CAPACITANCE; PULSE RISE TIME; SENSITIVITY; PREAMPLIFIERS; SPECIFICATIONS; TIME RESOLUTION; TIME-OF-FLIGHT SPECTROMETERS; TIMING CIRCUITS

1189 (ZfK–584, pp. 102) **Suppression of low-multiplicity γ-radiation in plunger experiments by means of coincidence technique.** Winter, G.; Schulze, W.; Will, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. LI-DRIFTED GE DETECTORS/coincidence spectrometry; LI-DRIFTED GE DETECTORS/gamma spectra; NAI DETECTORS/coincidence spectrometry; NAI DETECTORS/gamma spectra; ALPHA REACTIONS; BACKGROUND RADIATION; CHARGE PLUNGER METHOD; CORRECTIONS; EFFICIENCY; KRYPTON 79; MULTIPLICITY; NEUTRONS; SELENIUM 77 TARGET; SPECIFICATIONS

1190 (ZfK–584, pp. 109) **Optimization of the associated particle (AP) detection system used for time-correlated associated-particle method (TCAPM) fission cross-section measurements in the 4.5 and 8.5 MeV neutron energy range.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Musiol, G.; Pausch, G.; Ganza, E.A. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. RADIATION DETECTORS/optimization; RADIATION DETECTORS/particle identification; BACKGROUND RADIATION; CORRECTIONS; CORRELATIONS; COUNTING TECHNIQUES; CROSS SECTIONS; FISSION NEUTRONS; HELIUM 3; HELIUM 4; MEV RANGE 01-10; OPTIMIZATION

1191 (ZfK–584, pp. 111) **Experimental determination of the $^{3}He(d,p)^{4}He$ background portion in time-correlated associated-particle method (TCAPM) measurements of about 19 MeV neutron energy.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Merla, K.; Musiol, G.; Pausch, G.; Drapchinsky, L.V.; Ganza, E.A. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. TELESCOPE COUNTERS/coincidence circuits; TELESCOPE COUNTERS/proton detection; BACKGROUND RADIATION; CORRECTIONS; CORRELATIONS; CROSS SECTIONS; DEUTERON REACTIONS; FISSION NEUTRONS; HELIUM 3 TARGET; HELIUM 4; PARTICLE DISCRIMINATION; PROTONS; SPECIFICATIONS; TRITIUM TARGET

1192 (ZfK–584, pp. 113) **Consideration of the $^{12}C(n,n')3\alpha$-reaction as a background source within a methan filled fission chamber for neutrons of $\sim$ 19 MeV.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Merla, K.; Musiol, G.; Pausch, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION CHAMBERS/coincidence methods; FISSION CHAMBERS/particle discrimination; ALPHA PARTICLES; BACKGROUND RADIATION; CARBON 12 TARGET; CORRECTIONS; CORRELATIONS; CROSS SECTIONS; ENERGY SPECTRA; METHANE; NEUTRON REACTIONS; SPECTRA UNFOLDING

1193 (ZfK–584, pp. 117) **Separation of outer-shell satellite X-ray lines at sources of highly ionized atoms.** Wagner, W. (Joint Inst. for Nuclear Research, Dubna (USSR)); Zschornack, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. X-RAY SPECTROMETERS/charge states; X-RAY SPECTROMETERS/energy resolution; ENERGY-LEVEL TRANSITIONS; ION SOURCES; IONIZATION; LINE WIDTHS; LITHIUM FLUORIDES; SILICON OXIDES; SPECTRAL SHIFT; X-RAY SPECTRA

1194 (ZfK–584, pp. 118) **Temperature control of analyzer crystals in crystal diffraction spectrometers with discontinuous optimized controllers.** Keiseler, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods); Zschornack, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. X-RAY SPECTROMETERS/diffraction methods; X-RAY SPECTROMETERS/temperature control; ACCURACY; CONTROL EQUIPMENT; CRYSTALS; OPTIMIZATION; STABILITY; TIME DEPENDENCE

1195 (ZfK–584, pp. 121) **Fast trigger for neutron time-of-flight measurement.** Eckstein, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Meister, A.; Gohs, U. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic

Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. NEUTRON DETECTORS/time-of-flight method; NEUTRON DETECTORS/trigger circuits; DEAD TIME; GLASS SCINTILLATORS; PERFORMANCE TESTING; PHOTOMULTIPLIERS; RESONANCE; SPECIFICATIONS; TRANSMISSION

1196 (ZfK–584, pp. 122) **Gradually evaporated foils for aberration correction of fission fragment time-of-flight in a direction-sensitive arrangement.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Richter, D.; Neubert, W.; Probst, I. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION FRAGMENTS/geometrical aberrations; FISSION FRAGMENTS/time-of-flight method; POSITION SENSITIVE DETECTORS/fission fragments; POSITION SENSITIVE DETECTORS/foils; CORRECTIONS; EVAPORATION; FOILS; SPECIFICATIONS; STOPPING POWER; THICKNESS; VARIATIONS

1197 (ZfK–584, pp. 123) **Experimental arrangement for the measurement of correlations between fission products and neutrons.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Richter, D.; Seeliger, D.; Fromm, W.D.; Neubert, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION FRAGMENTS/coincidence spectrometry; FISSION FRAGMENTS/data acquisition systems; FISSION NEUTRONS/coincidence spectrometry; FISSION NEUTRONS/data acquisition systems; ANGULAR DISTRIBUTION; CORRELATIONS; NEUTRON DETECTORS; POSITION SENSITIVE DETECTORS; SPECIFICATIONS; SPECTRA UNFOLDING; TIME-OF-FLIGHT METHOD

1198 (ZfK–584, pp. 100) **Fast discriminator with low-level threshold.** Iljin, A.I.; Neubert, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. RADIATION DETECTORS/discriminators; AVALANCHE QUENCHING; LOW LEVEL COUNTING; PREAMPLIFIERS; DISCRIMINATORS; SPECIFICATIONS; TIME MEASUREMENT; TIME-OF-FLIGHT METHOD

1199 (ZfK–584, pp. 103) **Majority coincidence unit.** Will, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short communication. LI-DRIFTED GE DETECTORS/coincidence circuits; NAI DETECTORS/coincidence circuits; DATA PROCESSING; LOGIC CIRCUITS; SPECIFICATIONS; TIMING PROPERTIES

1200 (ZfK–584, pp. 135) **Evaluation of $\gamma\gamma$-coincidence matrices.** Enghardt, W. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GAMMA RADIATION/c codes; GAMMA RADIATION/coincidence spectrometry; BACKGROUND RADIATION; CORRECTIONS; DATA PROCESSING; MAGNETIC TAPES

1201 (ZfK–584, pp. 136) **On-line programs for multi-parameter measurements.** Fromm, W.D. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. PARTICLE IDENTIFICATION/multi-parameter analysis; PARTICLE IDENTIFICATION/x codes; DATA ACQUISITION; DATA PROCESSING; ENERGY SPECTRA; FORTRAN; MEMORY DEVICES; ON-LINE MEASUREMENT SYSTEMS; ONE-DIMENSIONAL CALCULATIONS; SPECIFICATIONS; TWO-DIMENSIONAL CALCULATIONS

1202 A neutron spectrometer for neutron energies between 1 eV and 10 keV. Wang, C.K.; Blue, T.E. *Transactions of the American Nuclear Society (USA),* 57: 79 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In boron neutron capture therapy (BNCT), it is the consensus that epithermal neutron beams have advantages over thermal beams in treating deep-seated brain tumors, and large neutron fields have advantages over narrow beams, since whole-brain irradiations are thought to be necessary in many cases. Epithermal neutron sources for BNCT, which include filtered reactor neutron beams and moderated reactor neutron fields, are currently being developed at many institutions around the world. Neutrons with energies between 1 eV and 10 keV are most suitable for treating brain tumors. However, techniques for measuring neutron spectra in a vacuum in this energy range are not well developed. This paper describes a new type of neutron spectrometer that has a set of response functions that peak at equally spaced intervals on a logarithmic energy scale ranging from 1 eV to 10 keV; therefore, neutron spectra (or histograms) in this energy range can be obtained by properly applying spectrum unfolding techniques to the measured data. The spectrometer is applicable for measurements in a vacuum for both narrow neutron beams and wide neutron fields.

1203 A calorimeter for relativistic heavy-ion experiments. Beavis, D. (Brookhaven National Lab., Upton, NY (USA)); Chu, Y.Y.; Chumming, J.B.; Duek, E.; Haustein, P.E.; Katcoff, S.; Betts, R.R.; Kaufman, S.B.; Bloomer, M.A.; Juricic, I. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(2): 367-372 (1 Sep 1989).

An iron-scintillator sampling calorimeter is described for measurement of the energy of projectile-like fragments and forward reaction products from interactions of 13.6 GeV/nucleon heavy ions with complex nuclei. Studies of the response of this device to charge- and mass-identified ions from ^{1}H to ^{28}Si indicate good linearity over the range 14-381 GeV with a resolution, $\sigma/\sqrt{E}$ of 0.73 $GeV^{1/2}$. Some factors that influence the resolution of heavy-ion calorimeters are discussed. (orig.).

1204 Three-dimensional survey techniques for large detector systems. Huth, J. (Fermi National Accelerator Lab., Batavia, IL (USA)); Moore, C.D. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(3): 485-488 (15 Sep 1989). DOE Contract AC02-76CH03000.

This paper describes several novel survey techniques which have been developed for the Collider Detector at Fermilab (CDF). These techniques include the collection and manipulation of survey data from a large multipurpose colliding beams detector. (orig.).

1205 Out-of-plane spectrometry: Why and how. Papanicolas, C.N. (Illinois Univ., Urbana (USA). Dept. of Physics); Alarcon, R.; Cardman, L.S.; Dolfini, S.; Laszewski, R.M.; Mandeville, J.; Williamson, S.E.; Wood, S.A.; Bernstein, A.M. *Nuclear Physics [Section] A (Netherlands),* 497: 497 (26 Jun 1989). (CONF-8806236–: 1. European workshop on hadronic physics in the 1990's with multi-GeV electrons, Seillac (France), 27 Jun - 1 jul 1988).

Out-of-plane detection capability is required in order to exploit the full potential of coincident electron scattering. We review here some of the most compelling arguments for out-of-plane spectrometry and offer some illustrative examples of the power of the technique. We then examine how such a capability can be realized in the environment of intermediate energy electron accelerators. Finally, we introduce a novel approach for the isolation of nuclear/nucleon responses based on simultaneous measurements by an array of spectrometers. (orig.).

1206 NE110 scintillator response to 10-100 MeV carbon ions. Dickens, J.K. (Oak Ridge National Lab., TN (USA)); McConnell, J.W. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(3): 577-580 (15 Sep 1989). DOE Contract AC05-84OR21400.

Measurements of the response of NE110 organic scintillator to 13, 34, 44, 70 and 95 MeV incident carbon ions are reported. (orig.).

1207 Composite charged particle detectors with logarithmic energy response for large dynamic range energy measurements. Fowler, M.M. (Los Alamos National Lab., NM (USA)); Begemann-Blaich, M.L.; Blaich, T.; Boissevain, J.A.; Gavron, A.; Jacak, B.V.; Lysaght, P.S.; Wilhelmy, J.B.; Sangster, T.C.; Britt, H.C. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(3): 517-527 (15 Sep 1989). DOE Contract W-7405-ENG-48;W-7405-ENG-36;AC03-76SF00098.

We have developed an array of detectors to identify charged particles produced in heavy ion reactions. The array, which consists of eight individual detector modules and a forward hodoscope, subtends a solid angle of 0.58π and covers 62% of the reaction plane in laboratory coordinates. Each of the eight identical modules has an active area which extends 13^0 above and below the array plane with additional limited coverage between 13^0 and 26^0. Each module measures the position, energy and velocity of charged particles over a dynamic range which extends from minium ionizing protons with energies up to 200 MeV to highly ionizing fission fragments with Coulomb-like energies. Position and time-of-flight are measured with low pressure multiwire proprotional counters (MWPC). Total energies for heavier ions are obtained from large ion chambers. Energy and position measurements for more energetic lighter ions which pass through the ion chambers are made with segmented phoswich arrays. The forward angle hodoscope is a 34-element array of phoswich detectors mounted symmetrically around the beam axis. These detectors are sensitive to beam velocity particles (E/A > 10-40 MeV/A) and capable of elemental resolution from protons to Z = 23. (orig.).

1208 Multisegmented ionization chamber dosimetry system for flight ion beams. Renner, T.R. (Lawrence Berkeley Lab., CA (USA)); Chu, W.T.; Ludewigt, B.A.; Nyman, M.A.; Stradtner, R. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 281(3): 640-648 (15 Sep 1989). DOE Contract AC03-76SF00098. Grant NIH CA-30236.

A system for measuring doses delivered by light ions has been developed for use in the treatment of cancer patients at the Biomedical Facility at the Bevalac. Dose distributions for treatment areas as large as 30 cm by 30 cm with 2.5 cm by 2.5 cm spatial resolution can be measured in real-time for use with dynamic beam delivery systems where precision and fast response time are required. Ionization chambers with transverse spatial resolution of 2 mm have also been made for measurements requiring fine spatial resolution. (orig.).

1209 ACP/R3000 processors in data acquisition systems. Deppe, J. (Fermi National Accelerator Lab., Batavia, IL (USA)); Areti, H.; Atac, R.; Biel, J.; Cook, A.; Edel, M.; Fischler, M.; Gaines, I.; Husby, D.; Isely, M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1577-1579 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The authors describe ACP/R3000 processor based data acquisition systems for high energy physics. This VME bus compatible processor board, with a computational power equivalent to 15 VAX 11/780s or better, contains 8 Mb of memory for event buffering and has a high speed secondary bus that allows data gathering from front end electronics.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 1074

1210 (AD-A–210165/7/XAB) **Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988.** Shanfield, Z.; Srour, J.R.; Moriwaki, M.; Kitazaki, K.S.; Hartmann, R.A. Northrop Research and Technology Center, Palos Verdes Peninsula, CA (USA). 16 Sep 1988. 160p. (NRTC–88-22-R). Available from NTIS, PC A08/MF A01.

Results of a study of radiation effects on electronic materials, devices, and integrated circuits are presented in this report. Emphasis was placed on determining the underlying mechanisms responsible for observed radiation effects with a view toward gaining an understanding of the value in the development of radiation-hardened devices. Measurements and analyses were performed on the effects of single energetic neutrons and protons on silicon integrated circuits. In addition, a detailed description is given of the effects of radiation-induced displacement damage on device depletion regions. Single-event upset studies included charge-collection and transient-current measurements on Si and GaAs devices following a single alpha-particle strike. The angular dependence of charge funneling was also investigated. The mechanisms of ionizing radiation effects on Si MOS devices were explored in detail using the thermally stimulated current technique and other measurement approaches. Data obtained by several techniques show that use of the radiation-induced shift of the capacitance-voltage curve at midgap is not generally valid for determining oxide trapped charge.

1211 (SAND–89-2539C) **The effects of heavy particle radiation on semiconductor devices.** Gover, J.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8911103–1: Japan Atomic Energy Research Institute symposium, Takasaki (Japan), 6-10 Nov 1989). Order Number DE90001679. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Heavy particle radiation can produce upsets in digital circuits as well as trigger burn out or breakdown in power MOSFETs and MNOS nonvolatile memories. Latch-up may also be stimulated by heavy ions. This report covers work done on the effects of heavy particle radiation on PN junctions, CMOS inverters, CMOS latch, MOSFET and non-volatile memories. 15 refs., 3 figs.

4403 Miscellaneous Instruments

Refer also to citation(s) 255, 456, 631, 871, 880, 883, 884, 894, 993, 994, 1065, 1066, 1107, 1227, 1376

1212 (BNL–43250) **The uses of synchrotron radiation sources for elemental and chemical microanalysis.** Chen, J.R.;

Chao, E.C.T.; Minkin, J.A.; Back, J.M.; Jones, K.W.; Rivers, M.L.; Sutton, S.R. Brookhaven National Lab., Upton, NY (USA). Aug 1989. 31p. Sponsored by U.S. DOE Energy Research; National Science Foundation; State University of New York; U.S. Geological Survey. DOE Contract AC02-76CH00016. (CONF-8908165–1: 5. international conference on PIXE and its analytical applications, Amsterdam (Netherlands), 20-26 Aug 1989). Order Number DE90001269. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Synchrotron radiation sources offer important features for the analysis of a material. Among these features is the ability to determine both the elemental composition of the material and the chemical state of its elements. For microscopic analysis synchrotron x-ray fluorescence (SXRF) microprobes now offer spatial resolutions of 10μm with minimum detection limits in the 1–10 ppM range depending on the nature of the sample and the synchrotron source used. This paper describes the properties of synchrotron radiation and their importance for elemental analysis, existing synchrotron facilities and those under construction that are optimum for SXRF microanalysis, and a number of applications including the high energy excitation of the K lines of heavy elements, microtomography, and XANES and EXAFS spectroscopies. 45 refs., 8 figs., 1 tab.

1213 (CRIE-T–87077) **Optical acoustic sensor using optical fiber.** Tanabe, Kazuo. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Oct 1988. 35p. (In Japanese). Order Number DE89901267. Available from NTIS (US Sales Only), PC A03/MF A01.

Microphone or sensor utilizing optical technique (optical microphone or sensor) of optical acoustic conversion technique was surveyed. The optical sensor is composed of OF functional type in which optical fiber (OF) is used as a sensor and of transmission line type (fiber acoustic sensor) in which other acousto-optic transducer part is fitted at the top of OF or in the line. Both types intend to measure acoustic pressure at one point in a space. In case of fiber interferometer device of OF functional type, minimum detectable pressure level is 100-120dB$_{ref.}$ μPa which is not yet sufficient, but may be possible to measure the pressure distribution in future. In case of latter type, it was 57dB$_{ref.}$$\mu$pa which can be used practically. 55dB$_{ref.}$$\mu$Pa or less may be detectable when utilizing side hole fiber, coating plastic on fiber to raise the acoustic sensitivity and constructing single optical path heterodyne detection system. This system may enable the measurement of pressure distribution. Acoustic fiber sensor having high sensitivity to sound may be useful for a part of the diagnosis and monitoring system for electric power system. 52 refs., 18 figs., 3 tabs.

1214 (LBL–26499) **Stopping rules, Bayesian reconstructions and sieves.** Llacer, J.; Veklerov, E.; Nunez, J. Lawrence Berkeley Lab., CA (USA). Jun 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890605–2: 11. information processing in medical imaging international conference, Berkeley, CA (USA), 19-23 Jun 1989). Order Number DE90001420. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the last two years, our group has been working on the concept of "feasible" images in the context of image reconstruction for emission tomography (ET). The concept has been discussed previously in image processing in astronomy, but had not been applied to tomographic image reconstruction until we related the deterioration of Maximum Likelihood Estimator (MLE) images at large number of iterations to the unfeasibility of the resulting images. We have described a feasible image as an image that, if it were a true radioisotope distribution in a patient, could have generated the measured data by the Poisson process that governs the radioactive decay process. Formal definitions of feasibility, as well as tests that can be applied to computer generated data or to real tomographic data, have been given in the literature cited above. 18 refs., 3 figs.

1215 (LBL–27668) **A program for calculating and plotting soft x-ray optical interaction coefficients for molecules.** Thomas, M.M.; Davis, J.C.; Jacobsen, C.J.; Perera, R.C.C. Lawrence Berkeley Lab., CA (USA). Aug 1989. 13p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890802–13: 7. synchrotron radiation instrumentation (SRI) national conference, Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90001141. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Comprehensive tables for atomic scattering factor components, f1 and f2, were compiled by Henke et al. for the extended photon region 50 - 10000 eV. Accurate calculations of optical interaction coefficients for absorption, reflection and scattering by material systems (e.g. filters, multi-layers, etc...), which have widespread application, can be based simply upon the atomic scattering factors for the elements comprising the material, except near the absorption threshold energies. These calculations based upon the weighted sum of f1 and f2 for each atomic species present can be very tedious if done by hand. This led us to develop a user friendly program to perform these calculations on an IBM PC or compatible computer. By entering the chemical formula, density and thickness of up to six molecules, values of the f1, f2, mass absorption transmission efficiencies, attenuation lengths, mirror reflectivities and complex indices of refraction can be calculated and plotted as a function of energy or wavelength. This program will be available distribution. 7 refs., 1 fig.

1216 (SAND–89-8251) **SAND DEVIL: A digital video link for telemetry applications.** Meacham, J.A.; Ottesen, C.W.; Bell, R.M. Sandia National Labs., Livermore, CA (USA). Oct 1989. 110p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DR00789. Order Number DE90001879. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A digital video encoder/decoder has been built which is suitable for airborne telemetry. The system allows the use of multiple black and white or a single RGB camera. The spatial resolution, frame rate, and pixel compression algorithm can be tailored to specific mission requirements. The output bit rate of the encoder can be varied from 0.89 to 7.16 Mbit/sec, depending on test range capability and rf data link considerations. The digital output of the encoder can be encrypted for data security. The system architecture is flexible, yet very simple, leading to a compact design. Also, the entire system is implemented with off-the-shelf components, thus reducing development time and cost. The size of the encoder and decoder can be reduced substantially by using surface mount devices. 3 refs., 19 figs.

1217 Langmuir probe characteristics in RF glow discharges. Hershkowitz, N. (Univ. of Wisconsin, Madison (USA)); Cho, M.H.; Nam, C.H.; Intrator, T. *Plasma Chemistry and Plasma Processing (USA),* 8(1): 35-52 (Mar 1988). DOE Contract AC02-78ET51015.

The current-voltage characteristics of Langmuir probes in rf glow discharges can be misinterpreted by the effects of rf time averaging, ionization near a probe, and expansion of the probe sheath. This paper presents a new Langmuir probe technique which can be used to determine the plasma parameters in rf glow discharges. Simple expressions for the time averaged I-V characteristics are derived for the cases of fully sinusoidal and partially rectified plasma potential waveforms. Examples of corresponding I-V characteristics obtained from argon rf glow discharges are also illustrated.

1218 Adaptation of dependex fittings to International Standards Organization fittings. Stockli, M.P. (Department of Physics, Kansas State University, Manhattan, Kansas 66506 (US)); Hill, D. *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films (USA),* 7(5): 3124-3126 (Sep 1989).

Dependex flanges are widespread in traditional nuclear research laboratories equipped with an HVEC accelerator, but are not common elsewhere because the modern vacuum community adapted the ISO and the ASA norms for standard O-ring sealed high-vacuum joints. Therefore, many traditional nuclear research laboratories have a frequent need for adapters in order to attach equipment with new standards to their systems. We show in this note the close match between the dependex and the ISO standards, which allows one to join the flanges with a minimum of adapting hardware. (AIP)

1219 Wavelength choice for soft x-ray laser holography of biological samples. London, R.A. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550 (US)); Rosen, M.D.; Trebes, J.E. *Applied Optics (USA),* 28(16): 3397-3404 (15 Aug 1989). DOE Contract W-7405-ENG-48.

The choice of an optimal wavelength for soft x-ray holography is discussed, based on a description of scattering by biological structures within an aqueous environment. We conclude that wavelengths slightly longer than the 43.7 A carbon K-edge provide a good trade off between minimizing the necessary source power and the dose absorbed by the sample and maximizing the penetrability of the x-rays through wet samples. This differs from the previous notion that wavelengths within the water window (between 23.2 A and 43.7 A) would be the best for holography. The problem of motion resulting from the absorption of x rays during a short exposure is described. The possibility of using ultrashort exposures in order to capture the image before motion can compromise the resolution is explored. The impact of these calculations on the question of the feasibility of using an x-ray laser for holography of biological structures is discussed.

4404 Well Logging Instrumentation

1220 **Some geometric modeling and tracking codes for Monte Carlo particle transport including direction biasing techniques.** Gardner, R.P.; Verghese, K.; Prettyman, T.H.; Mickael, M. *Transactions of the American Nuclear Society (USA)*, 57: 115-116 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In Monte Carlo simulation, one is interested in the particle tracking process in two major ways. The first of these is in simply keeping track of where the particle is in relation to the various homogeneous zones that are used to simulate the spatial domain of interest through which the particle moves randomly in phase space. The second of these, which is becoming more and more important, is in forcing particles either in a preferred general direction (direction biasing) or to exactly intersect a particular zone. This latter process is essential in the statistical estimation variance reduction process in which the result of interest (e.g., particle detection) is forced to occur at each particle interaction point. These processes have many factors in common when treated mathematically. This paper describes experience in developing and using mathematical algorithms for these general tracking and forcing processes in the Monte Carlo modeling of nuclear well-logging tools and industrial tomographic devices.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

Refer also to citation(s) 1058

1221 (LA-UR–89-3000) **Detonation chemistry studies of energetic materials using laboratory scale samples.** Blais, N.C.; Greiner, N.R.; Fernandez, W.J. Los Alamos National Lab., NM (USA). [1989]. 47p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8909182–3: NATO advanced study institute on chemistry and physics of molecular processes in energetic materials, Sicily (Italy), 2-15 Sep 1989). Order Number DE90000536. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe an apparatus by which the detonation products of an explosive can be identified and whose relative concentrations can be determined quantitatively. These measurements can be made on products that have been formed in less than one microsecond after the passage of the detonation wave. The technique is based on the rapid quenching of chemical reactions by virtue of the free expansion of the products into vacuum. Of course, products that have been formed over a longer period of time and under different pressure/temperature conditions can also be studied. Time resolved molecular-beam mass spectrometry is used, so that whether detonation occurred or not in forming the products can be determined. We describe optical techniques, principally Schlieren photographs, that also confirm detonation. We report measurements made on six standard explosives, PETN, RDX, HMX, HNS, TNT and TATB, and one research explosive, nitric oxide. For none of the standard explosives do we measure product distributions that agree with model predictions based on equilibrium assumptions. A computer model of the free expansion is described briefly and its importance to the interpretation of the data is emphasized. 16 refs., 13 figs.

1222 (SAND–86-0141) **Studies of the adsorption/desorption behavior of explosive-like molecules.** Kenna, B.T.; Conrad, F.J. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 36p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90001867. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a general study of the adsorption/desorption behavior of explosive-like molecules as a function of temperature. Capillary column gas chromatography was used in conjunction with bare fused silica and borosilicate glass columns. Adsorption rate constants and energies of adsorption/desorption are estimated. A possible adsorption mechanism is addressed which involves a Lewis acid-base type of interaction between the molecules and substrate coupled with island formation by the adsorbed molecules. 31 refs., 4 figs., 5 tabs.

1223 (SAND–89-2259C) **Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB).** McCampbell, C.B.; Bickes, R.W. Jr.; Schlobohm, S.L. Sandia National Labs., Albuquerque, NM (USA). [1989]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910224–1: American Defense Preparedness Association annual meeting, New Orleans, LA (USA), 3-4 Oct 1989). Order Number DE90000778. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electroexplosive devices conventionally use small metal bridgewires (hot wires) to ignite pyrotechnic and other energetic powders. Typically, hot-wire pyrotechnic ignition takes place a few milliseconds after a current pulse of at least 20 mJ is applied to the bridgewire. In contrast, we report here a new means for ignition that produces a usable explosive output in less than 125 μs after application of a current pulse of less than 2 mJ energy to the device. Our igniter is a semiconductor bridge (SCB) which is a heavily doped polysilicon region defined on a silicon substrate. Despite the low energies needed for powder ignition, SCBs have excellent no-fire characteristics, better than the hot wires because of the intimate contact of the SCB bridge with the underlying substrate. In addition, experiments show very good electrostatic discharge characteristics; application of the current pulse obtained from a 500-pF capacitor charged to 25 kV to our SCB test devices in series with a 5000-Ω resistor produced no bridge damage. In this paper we will discuss the energy required for explosive ignition with SCBs as a function of bridge size and ESD tests. We will also briefly discuss SCB processing and die mounting procedures that lend themselves to automated component assembly. 2 refs., 5 figs., 1 tab.

4502 Nuclear

Refer also to citation(s) 749, 1974

1224 (AD-A–207450/8/XAB) **Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989.** Ramirez, T.L.; Pence, R. Defense Information Analysis Center, Edgewood, MD (USA). 30 Dec 1988. 302p. (CBIAC–88-113). Available from NTIS, PC A14/MF A01.

The purpose of this review was to continue gathering available literature applicable to the Physiological and Psychological Effects of Nuclear/Biological/Chemical and Extended Operations on Crew (P2NBC2) performance. Over 1300 abstracts were reviewed and approximately 500 of those were found which contained applicable information. The review is presented by year and an index of the bibliographic citations is also provided.

1225 (AD-A–209795/4/XAB) **Soviet strategic nuclear doctrine under Gorbachev. Study project.** Winkel, R.J. Army War Coll., Carlisle Barracks, PA (USA). 27 Apr 1989. 24p. Available from NTIS, PC A03/MF A01.

This paper examines Soviet offensive strategic nuclear doctrine under General Secretary and President Mikail S. Gorbachev. The

development of Soviet nuclear doctrine starting with the Stalin era is reviewed. A close look at those pieces of Gorbachev's new thinking that pertain to nuclear weapons doctrine are presented. Implications for U.S. strategy are offered.

1226 (AD-A-210072/5/XAB) **Introduction to the operational nuclear-survivability assessment process. Technical paper.** Air Force Operational Test and Evaluation Center, Kirtland AFB, NM (USA). Apr 1988. 59p. Available from NTIS, PC A04/MF A01.

The objective of this document is to introduce the AFOTEC project analyst to the process of conducting an operational assessment of weapon-system performance in the nuclear-threat environment. A Nuclear Assessment Methodology (NAM) was developed and implemented to assess weapon-system operational effectiveness. The goal of the operational nuclear survivability process is to assess the weapon system performance characteristics and employment techniques that are impacted by operation in the nuclear-threat environment. The focus of this document is how this methodology is implemented for various types of weapon systems from both a technical and management perspective. The intent is to provide the project analysis: (1) a basis for effectively managing operational test and evaluation nuclear-survivability assessments and (2) a top-level understanding of the technical requirements. This section presents a brief discussion of the AFOTEC role in the acquisition process of major Air Force systems and presents an overview of the OT&E NAM. Subsequent sections will describe in more detail how the methodology is implemented and the types of results the project analyst may expect from an assessment. A brief description of nuclear effects is provided to familiarize the project analyst with the terminology and environments related to nuclear weapons.

1227 (AD-A-210107/9/XAB) **Optimal sensor configuration and survivable processing with correlated noise. Final report.** Mahmood, S.; Mehra, R.K. Scientific Systems, Inc., Cambridge, MA (USA). 1 May 1989. 85p. Avaiiable from NTIS, PC A05/MF A01.

The research proposed under this project is concerned with the problem of accurate target tracking in the SDI environment. The SDI scenario considered in this report is as follows: Multiple sensors that are possibly located at dispersed geographical locations are observing a single target. The measurement noises are correlated across the sensors. The local processors attached with the sensors possibly may not have the complete information of the target model. The tracking problem can be solved in two ways: first, the sensor measurements can be transmitted to a central node where the optimal state can be estimated conditional on all the measurement history-this is centralized processing. Alternatively, each sensor can process its own measurement locally and send (some function of) processed data to the central node. Here it is fused with other incoming data into the global estimate-this is decentralized processing. The latter is superior to the centralized processing from the system performance considerations in the face of node failures. There exists a good amount of literature in the area of decentralized estimation in the presence of uncorrelated sensor noise. In this work, the available results have been extended to the case of correlated sensor noise under the assumption that the local central node only one vector of the dimension of the state.

1228 (CONF-8909163–Absts.) **5th symposium on containment of underground nuclear explosions.** Lawrence Livermore National Lab., CA (USA). [1989]. 40p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. From 5. symposium on containment of underground nuclear detonations; Santa Barbara, CA (USA); 19-21 Sep 1989. Order Number DE89017760. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document contains the abstracts of 61 papers presented at the symposium. Topics include stress measurements, line-of-sight events, tunnel and cavity events, stemming and gas flow, hydrofracture and material properties, ground motion and stress, event modeling and cavity phenomena, hydrology and mineralogy, geophysics and material properties, and geologic structure. (TEM)

1229 (CONF-8910241–1) **Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah.** Lee, K.D.; Puphal, K.W.; Lee, Yun Ko. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA). [1989]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-89NV10630. From 35. conference on bioassay, analytical and environmental chemistry; Charleston, SC (USA); 30 Oct - 2 nov 1989. Order Number DE90001482. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In 1979, the US Department of Energy (DOE) initiated the Off-Site Radiation Exposure Review Project (ORERP) in response to increased public concern about the population dose of radiation from fallout originating at the Nevada Test Site (NTS). One of many functions of the project is to analyze Pu-239+240 in soil samples collected from the surrounding areas of the Nevada Test Site. A large amount of soil was collected in Hurricane, Utah, pulverized and carefully homogenized to serve as the quality control standard sample. Hurricane soil was analyzed along with every batch of soil samples. Procedures for samples collection, preparation, chemical separation and spectroscopic analysis of the Hurricane soil are described elsewhere. 2 refs., 2 tabs.

1230 (UCID–21758) **The cost effectiveness of modernized US strategic forces.** Chrzanowski, P.L. Lawrence Livermore National Lab., CA (USA). Sep 1989. 45p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001881. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A methodology to compare the cost effectiveness of modernized US strategic forces is presented and demonstrated using open literature sources for cost and performance. An important figure of merit that is used is the number of effective weapons per program dollar spent. For weapons to be effective, they must survive a first strike, be reliable, and penetrate Soviet defenses to reach the intended target. With the cost numbers gathered and assumptions used about force effectiveness, we are able to make some comparisons among possible future force options. Perhaps the most important factor in the analysis is the alert status of US forces at the time of a Soviet first strike, and the conclusions drawn must be qualified by the assumptions made about force readiness at the time of the attack. 12 refs., 12 figs., 3 tabs.

1231 (UCRL–21226) **Containment analysis for LLNL: 1988: Final report.** Nilson, R.H.; Lie, K.H.; Peterson, E.W. Lawrence Livermore National Lab., CA (USA); S-Cubed, La Jolla, CA (USA). 17 Feb 1989. 116p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001185. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A double-porosity model which recognizes fracture permeability as well as matrix permeability is used to investigate some aspects of gas flow from the cavity produced by an underground nuclear explosion. In its simplest form, the double-porosity model treats a family of identical, equally-spaced, vertical fracture planes separated by a permeable matrix material. The matrix properties are known from core sample data and the flow characteristics of the fracture system are constrained by field-scale measurements of the pneumatic diffusivity. Three different issues are investigated: estimation of fracture aperture vs. fracture spacing relationships based on pneumatic diffusivity data, transport of radioactive gases from a nuclear chimney to the earth's surface as a result of cyclical gas motions which are induced by barometric pressure variations, and seepage losses from a hydrofracture which is driven by high pressure cavity gas into a double-porosity overburden. The containment of cavity gases is generally favored by a large number of closely spaced fractures rather than a few more widely spaced fractures, both configurations having the same pneumatic diffusivity. The sensitivity of containment measures to unknown fracture configurations is explored, subject to the constraint of a known large-scale pneumatic diffusivity. 13 refs., 30 figs.

1232 (UCRL–101706) **Nuclear/conventional interaction in battlefield operations.** Warshawsky, A.S. Lawrence Livermore National Lab., CA (USA). Aug 1989. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910268–1: 28. Army operations research symposium, Ft. Lee, VA (USA), 11-12 Oct 1989). Order Number DE90001682. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Combat is a complicated enterprise. Simulating combat on a computer is no less complicated; it may even be harder (even if less lethal). Despite this, the role played by computer-based combat simulations to help answer vexing force structure and doctrinal

issues is increasing steadily. So too is the complexity of these models. These two facts challenge the military analyst's capability to identify cause and effect relationships, which often are obscured by the shear mass of data generated by simulations. The research discussed in this paper illustrates these assertions. The purpose was to identify (and quantify if possible) how nuclear weapons influence corps operations and plans. If nothing else was learned, this study demonstrated that some commonly used measures of effectiveness (MOE) do not adequately capture the essence of the simulated combat. In many respects, the work served as a case study showing the importance of the capability to examine simulation results with a graphics-based postprocessor as a way to interpret what happened and why.

4503 Explosion Detection

Refer also to citation(s) 1542, 1543

1233 (SAND–89-1512C) **Characterizing transient vibrations using band limited moments.** Smallwood, D.O. Sandia National Labs., Albuquerque, NM (USA). [1989]. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891152–2: 60. shock and vibration symposium, Virginia Beach, VA (USA), 14-16 Nov 1989). Order Number DE90000799. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A method is described to characterize shocks (transient time histories) in terms of the Fourier energy spectrum and the moments in the time domain of the shock passed through a contiguous set of band pass filters. It is then shown how realizations of a random process can be generated which in the mean will have the same energy and moments as the characterization of the transient event. 11 refs., 20 figs., 2 tabs.

1234 (UCRL–101542-Rev.1) **Non-intrusive verification: Revision 1.** Ebert, P.J. Lawrence Livermore National Lab., CA (USA). 4 Aug 1989. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908141–3-Rev.1: U.S. Department of Energy conference on technology research and development for arms control verification, Los Alamos, NM (USA), 29-31 Aug 1989). Order Number DE90001681. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A high-altitude nuclear explosion will produce a magnetic disturbance that is detectable at very large distances. The same effect is produced in an underground explosion and is detectable, but at much shorter distances. If the magnetic effect can be developed as a means of TTBT verification, it would be non-intrusive and applicable over a broad range of nuclear yields, perhaps to as low as 1 kiloton. This report identifies several technical advantages of this approach to verification, estimates the strength of detectable signals, and proposes a straightforward experiment that would lead to its development. 8 refs.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

Refer also to citation(s) 1262

1235 (CRIE-T–87097) **Characteristics of electromagnetic wave forms with lightning in winter season.** Tomita, Seietsu. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Sep 1988. 26p. (In Japanese). Order Number DE89901256. Available from NTIS (US Sales Only), PC A03/MF A01.

From measured results of lightning electromagnetic wave forms, the electromagnetic wave forms in winter season were classified, wave propagation under the thunder cloud was clarified and a countermeasure of DF(direction finder) singularity was described. Typical electromagnetic wave forms are one shot signal of positive polarity and bi-polar shot, and each of them is about a half. Sawteeth-like electromagnetic wave forms of negative polar lightning in summer are found smaller and the rate is only about 13%. Return stroke can appear immediately after bi-polar shot of shallow generation period. Received signal is sometimes larger from the distant lightning and smaller from the near lightning.Cause of DF singularity as self-discharge from the top of antenna was clarified and effectiveness of the loop antenna was identified. Electromagnetic wave forms of lightning triggered by a rocket were measured to confirm that some lightnings in winter cannot be judged as lightning by LLS, and that wave propagation under the thunder cloud is inhomogeneous. 15 refs., 16 figs., 3 tabs.

1236 (INIS-mf–12008) **Environmental and climate research programme 1988/89.** Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.). 1987. 25p. (In German). Order Number DE90717907. Available from NTIS (US Sales Only), PC A03/MF A01.

The Study Group of the Large-scale Research Institutes (AGF) has been reporting on these projects since 1972, in its programme for 'Environmental and Climate Research'. The programme, which is worked out by the AGF's Coordination Office for Environmental Research, is closely connected with the programmes of the Federal Government; it is revised and updated periodically by the AGF's Coordination Committees for 'Environmental Research' and 'Climate Research'. The 1988/89 programme gives an up-to-date overview of research projects in the field of 'Research and Technology for Health, Nutrition and the Environment' financed with the AGF programme budget of 1988. At the same time, however, it also documents projects of other areas of the programme concerned with environmental issues. Development trends are also discernible in the specification of the goals for 1989. The figures mentioned in the present programme are not comparable with those of earlier programmes, owing to inclusion of the programme section concerned with issues of climate, and to structural changes. (orig./KW).

1237 (INIS-mf–12009) **Parameterization of ice- and water clouds and their radiation-transport properties for large-scale atmospheric models.** Mitteilungen aus dem Institut fuer Geophysik und Meteorologie der Universitaet zu Koeln. Rockel, B. Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie. 1988. 121p. (In German). Order Number DE90717857. Available from NTIS (US Sales Only), PC A06/MF A01.

A model of cloud and radiation transport for large-scale atmospheric models is introduced, which besides the water phase also takes the ice phase into account. The cloud model can diagnostically determine the degree of cloud cover, liquid water and ice content by the parameters of state given by the atmospheric model. It consists of four submodels for non-convective and convective cloudiness, boundary layer clouds and ice clouds. An existing radiation model was extended for the parametrization of the radiation transport in ice clouds. Now this model allows to calculate the radiation transport in water clouds as well as in ice clouds. Liquid and solid water phases can coexist according to a simple mixture statement. The results of a sensitivity study show a strong reaction of the cloud cover degree to changes in the relative humidity. Compared with this, variations of temperature and vertical wind velocity are of minor importance. The model of radiation transport reacts most sensitively to variations of the cloud cover degree and ice content. Changes of these two factors by about 20% lead to changes in the average warming rates in the order of magnitude of 0.1 K. (orig./KW).

1238 (N–89-21287, pp. 33) **Global environmental effects of impact-generated aerosols: Results from a general circulation model.** Covey, C.; Ghan, S.J.; Weissman, P.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

Cooling and darkening at Earth's surface are expected to result from the interception of sunlight by the high altitude worldwide dust cloud generated by impact of a large asteroid or comet, according to the one-dimensional radioactive-convective atmospheric model (RCM) of Pollack et al. An analogous three-dimensional general circulation model (GCM) simulation obtains the same basic result as

the RCM but there are important differences in detail. In the GCM simulation the heat capacity of the oceans, not included in the RCM, substantially mitigates land surface cooling. On the other hand, the GCM's low heat capacity surface allows surface temperatures to drop much more rapidly than reported by Pollack et al. These two differences between RCM and GCM simulations were noted previously in studies of nuclear winter; GCM results for comet/asteroid winter, however, are much more severe than for nuclear winter because the assumed aerosol amount is large enough to intercept all sunlight falling on Earth. In the simulation the global average of land surface temperature drops to the freezing point in just 4.5 days, one-tenth the time required in the Pollack et al. simulation. In addition to the standard case of Pollack et al., which represents the collision of a 10-km diameter asteroid with Earth, additional scenarios are considered ranging from the statistically more frequent impacts of smaller asteroids to the collision of Halley's comet with Earth. In the latter case the kinetic energy of impact is extremely large due to the head-on collision resulting from Halley's retrograde orbit.

1239 (ORNL/CDIAC–27) **Antarctic surface temperature and pressure data.** Jones, P.D.; Limbert, D.W.S.; Boden, T.A. (ed.). Oak Ridge National Lab., TN (USA). Sep 1989. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (NDP–032). Order Number DE90000971. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3215.

This document presents monthly mean surface temperature and pressure data from 30 Antarctic stations. These data were assembled primarily from World Weather Records volumes for 1951–1960 and 1961–1979 and from Monthly Climatic Data for the World records since 1961. The periods of record vary by station. The earliest data are from 1903, and the most recent data are from 1988. All the assembled data were assessed for quality and for long-term homogeneity through the use of interstation comparison techniques. These data are available free of charge as a numeric data package (NDP) from the Carbon Dioxide Information Analysis Center. The NDP consists of this document and a magnetic tape containing machine-readable data files. This document provides tabular listings of the temperature and pressure data, describes how the data were processed, defines limitations and restrictions of the data, and provides reprints of pertinent literature. 25 refs., 3 figs., 11 tabs.

1240 **Mass and momentum balance in the Brush Creek drainage flow determined from single-profile data.** Dobosy, R.J. (Atmospheric Turbulence and Diffusion Division, NOAA/ARL, Oak Ridge, Tennessee (US)); Rao, K.S.; Przybylowicz, J.W.; Eckman, R.M. *Journal of Applied Meteorology (USA),* 28(6): 467-476 (Jun 1989).

Fluxes and flux-divergences of mass and momentum in Brush Creek Valley, computed from measurements taken by Tethersondes and Doppler sodars in the 1984 ASCOT experiment, are presented. Estimates of mass influx from open sidewalls in Brush Creek, derived from concurrent tower measurements, are also given. Mass and momentum fluxes calculated from single-profile data were within a factor of 1.5 of those obtained by integrating Doppler lidar data. Flux-divergences for budget calculations should be derived from a Doppler lidar or equivalent remote sensor data, because single-profile measurements were found to have sampling errors which are too large for reliable flux divergence estimates. The mass influx from the sidewalls was insufficient to account for the mass flux-divergence in the main valley. This imbalance in the drainage flow mass budget is speculated to be due to the inflow from the small box-canyon tributaries, rather than from subisdence of air above the main valley. ©1989 American Meteorological Society

1241 **Low-frequency velocity and temperature fluctuations in Katabatic Valley Flows*.** Stone, G.L. (Los Alamos National Laboratory, Los Alamos, New Mexico (US)); Hoard, D.E. *Journal of Applied Meteorology (USA),* 28(6): 477-488 (Jun 1989).

Observations of velocity and temperature fluctuations made during katabatic flow conditions in two deeply incised valleys are analyzed using variance, coherence, and phase spectra. Variance spectra obtained at valley floor sidewall locations show the presence of energetic low-frequency fluctuations in the horizontal velocity components and temperature. Under very stable conditions, these fluctuations dominate the spectra. Vertical velocity spectra also show enhanced activity in the same frequency bands. The time scale for these motions is an order of magnitude larger than expected for turbulent eddy motion within these valleys. Also, coherence and phase spectra show that these modes of motion have characteristics unlike turbulent motion; in particular, vertical velocity and temperature fluctuations are in quadrature. The observations suggest the presence of a field of progressive internal gravity waves. The influence these wave-like motions may have on mixing within valleys and the problems they cause in the analysis of turbulent fluctuations are discussed. ©1989 American Meteorological Society

1242 **Mean structure of the nocturnal drainage flow in a deep valley*.** Clements, W.E. (Los Alamos National Laboratory, Los Alamos, New Mexico (US)); Archuleta, J.A.; Hoard, D.E. *Journal of Applied Meteorology (USA),* 28(6): 457-462 (Jun 1989).

Wind and temperature data are collected by an instrumented tethered balloon and a Doppler lidar in a deep valley are used to investigate the mean properties of the nocturnal drainage flow down the valley on four nights when the wind at ridgetop had an up-valley component. We examine the vertical structure of the temperature and the vertical and horizontal structure of the drainage wind. An empirical description of the wind field is derived and used to estimate the mass flux from the drainage flow. Mean properties of the flow are presented and relationships among some of the parameters are examined. ©1989 American Meteorological Society

1243 **Representativeness of single vertical wind profiles for determining volume flux in valleys.** King, C.W. (NOAA/ERL/Wave Propagation Laboratory, Boulder, Colorado (US)). *Journal of Applied Meteorology (USA),* 28(6): 463-466 (Jun 1989).

Wind data collected by a Doppler lidar in a deep mountain valley are used to determine the representativeness of single vertical profiles for approximating the volume flux. A method is described that interpolates these profiles to be representative of an entire valley cross section and provides guidance fo rplacing vertically profiling sensors in future mountain valley studies. It is shown that the horizontal homogeneity assumption leads to large overestimates when volume fluxes are calculated using single vertical wind profiles. Proper sensor placement and a knowledge of the morphology of of the wind field within the valley leads to greater accuracies in estimated volume fluxes. ©1989 American Meteorological Society

1244 **Categorization of nocturnal drainage flows within the Brush Creek Valley and the variability of sigma theta in complex terrain.** Gudiksen, P.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California (US)). *Journal of Applied Meteorology (USA),* 28(6): 489-495 (Jun 1989). DOE Contract W-7405-ENG-48.

The monthly frequencies of nocturnal drainage flows in the Brush Creek Valley were estimated over the period August 1982–January 1985 for the purpose of evaluating the representativeness of the drainage flows observed during a few intensive study periods. These estimates were made on the basis of data from three short meteorological towers situated in the valley. The highest frequencies were observed during July to October timeframes: 30%–40% during 1983 and 5%–25% during 1984. Of the ten experimental nights when intensive investigations were conducted within the Brush Creek Valley, seven were during strong drainage flow periods and three were during weaker drainage flow periods. The variability of σ_θ in complex terrain areas was investigated since this parameter is often used to estimate diffusion of pollutants. Measurements made during strong drainage flow periods within two valleys in The Geysers geothermal area in northern California and within the Brush Creek Valley yielded median hourly averaged values that typically ranged from 15° to 40°. Generally, the highest values were acquired at measurement sites situated on the valley floor; the lowest values on the ridges; and intermediate values along the slopes. This ordering may be due to the winds generally being stronger over the ridges than within the valley, since there is weak evidence for an inverse relationship between the median wind speeds and σ_θ values, even though this relationship was not in evidence between the individual measurements. ©1989 American Meteorological Society

1245 **Deep valley radiation and surface energy budget microclimates. Part II: Energy Budget.** Whiteman, C.D. (Pacific Northwest Laboratory, Richland, Washington (US)); Allwine, K.J.;

Fritschen, L.J.; Orgill, M.M.; Simpson, J.R. *Journal of Applied Meteorology (USA)*, 28(6): 427-437 (Jun 1989). DOE Contract AC06-76RL01830.

Surface energy budget measurements were made concurrently at five sites located on the valley floor, sidewalls and ridgetop of Colorado's 650-m deep Brush Creek Valley (39°32′N, 108°24′W) on the nearly clear day of 25 September 1984 using the Bowen ratio energy budget technique. Daily average surface heat flux values for a natural sagebrush ecosystem on the floor of the semiarid valley included an input of 109 W m^{-2} net all-wave radiation and 15 W m^{-2} ground heat flux, and a loss of 48 W m^{-2} latent heat flux and 76 W m^{-2} sensible heat flux. Significant differences in instantaneous, daily, and daytime fluxes occurred from site to site as a function of slope aspect and inclination angles and surface properties, including vegetation cover and soil moisture. Strong contrasts in instantaneous latent and sensible heat fluxes occurred between the opposing northeast- and southwest-facing sidewalls of the valley as solar insolation varied through the course of the day and as shadows propagated across the valley. This differential heating and moistening of the air above the opposing slopes produces cross valley circulations and the resulting moisture and heat transports observed by other investigators.

1246 **Measurements of turbulent heat and momentum fluxes in a mountain valley.** Doran, J.C. (Pacific Northwest Laboratory, Richland, Washington (US)); Wesely, M.L.; McMillen, R.T.; Neff, W.D. *Journal of Applied Meteorology (USA)*, 28(6): 438-444 (Jun 1989). DOE Contract AC06-76RL01830.

Measurements of heat and momentum fluxes along the valley floor of Brush Creek in Colorado are described. The measurements were taken in the fall of 1984 as part of the Department of Energy's Atmospheric Studies in Complex Terrain field program. The sensible heat flux to the ground decreased from approximately 40–60 W m^{-2} prior to midnight to about 10–25 W m^{-2} in the morning hours. Surface friction velocities u_* ranged from approximately 20–15 cm s^{-1} during the corresponding time periods. Considerable site-to-site variability in flux values was found, and disturbances of the upwind flow appear to be a significant contributing cause. ©1989 American Meteorological Society

1247 **Deep valley radiation and surface energy budget microclimates. Part I: Radiation.** Whiteman, C.D. (Pacific Northwestern Laboratory, Richland, Washington (US)); Allwine, K.J.; Fritschen, L.J.; Orgill, M.M.; Simpson, J.R. *Journal of Applied Meteorology (USA)*, 28(6): 414-426 (Jun 1989). DOE Contract AC06-76RL01830.

Solar and longwave radiation data are presented for five sites in Colorado's 650 m deep semiarid Brush Creek Valley (39°32′N, 108°24′W) during September 1984. During the sunlit period of a nearly clear day, individual sites received 0.73–0.81 of the theoretical extraterrestrial solar radiation. Incoming solar radiation increased with elevation in the valley. Direct radiation made up 0.86–0.88 of the downward shortwave flux. On average, 0.12–0.21 of the incoming shortwave radiation was reflected at the individual sites. Strong variations in reflected solar radiation and outgoing longwave radiation occurred from site to site. Because of the large direct beam component, aspect and inclination angles of the valley surfaces had a strong effect on the solar radiation received. Contrasts between a southwest- and northwest-facing sidewall were significant. Shading from surrounding topography produced inter-site differences in both instantaneous and daily total radiation. Inter-site differences in most daily totals on a clear day were larger than standard deviations of the daily totals at a valley floor site computed over a 16-day period of variable weather. The ridgetop site, on account of its unobstructed view of the sky, had a higher average positive net radiation during the day and a higher average negative net radiation during the night than the valley stations. Observations averaged over a 15-day period of variable weather illustrated the general effect of cloudy weather in reducing contrasts in radiation climate among sits. A simple theoretical correction for radiation measured on a horizontal surface provided a useful estimate of net and global radiation on the underlying sloping surface. ©1989 American Meteorological Society

1248 **The accumulation and pooling of drainage flows in a large basin.** Neff, W.D. (NOAA/ERL Wave Propagation Laboratory, Boulder, Colorado (US)); King, C.W. *Journal of Applied Meteorology (USA)*, 28(6): 518-529 (Jun 1989).

We describe a sequence of tethersonde and sodar measurements showing the effects of the pooling of cold air drainages in a basin located along the Colorado River below the Brush Creek drainage. Results obtained during periods of weak ambient winds show that the basin fills over a period of several hours, then eventually overflows. The depth of the pool is such as to affect tributary drainages, such as that of Brush Creek, and to cause the accumulating drainage jets to become elevated as they flow down the larger drainage channels into the basin. ©1989 American Meteorological Society

1249 **Numerical simulation of drainage flow in Brush Creek, Colorado.** Leone, J.M. Jr. (Lawrence Livermore National Laboratory, University of California, Livermore, California (US)); Lee, R.L. *Journal of Applied Meteorology (USA)*, 28(6): 530-542 (Jun 1989). DOE Contract W-7405-ENG-48.

One of the objectives of the Atmospheric Studies in Complex Terrain (ASCOT) program is to develop numerical models that can be used to aid in the understanding and prediction of flow patterns observed over complex terrain. As part of this program, we have developed a three-dimensional dynamic model that uses a simplified finite element scheme combined with a variation of the forward Euler time integration scheme to solve the Boussinesq equations of motion over irregular terrain. We have used the model to simulate the development of the nocturnal down-valley circulation in the area where the ASCOT field observations were made at Brush Creek, Colorado. The model and the simulation results are described in this paper. ©1989 American Meteorological Society

1250 **Laser droplet heating: fast and slow heating regimes.** Park, B. (New Mexico State University, Physics Department, Las Cruces, New Mexico 88003 (US)); Armstrong, R.L. *Applied Optics (USA)*, 28(17): 3671-3680 (1 Sep 1989).

The heating of a laser-irradiated droplet is analyzed theoretically and numerically by solving the heat transport equation. Two regimes of droplet heating are considered, slow and fast heating. In the slow heating regime, the thermal diffusion term plays an important role and the droplet may not experience explosive vaporization during the lifetime of the laser pulse. In the fast heating regime, the vaporization term plays the dominant role and the temperature profile inside the droplet is similar to the heat production profile except for a thin shell near the surface. Numerical results are presented for the case of water droplets irradiated by 10.6 μm laser radiation.

5002 Chemicals Monitoring and Transport

Refer also to citation(s) 35, 77, 311, 312, 692, 720, 727, 736, 950, 1236, 1286, 1338, 1411, 1444, 1455, 1456

1251 (AD-A–209785/5/XAB) **Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report.** Garrison, J.A. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Mar 1989. 130p. (USAFOEHL–89-016EQ0146CEF). Available from NTIS, PC A07/MF A01.

At the request of HQ SAC/SGPB, compliance testing for particulate emissions was conducted on four silver-reclamation incinerators located in Bldg D, Offutt AFB NE. Testing was accomplished on 1-11 Nov 1988. Testing was required by the State of Nebraska Department of Environmental Control. The State of Nebraska requested the evaluation of emissions for hydrogen chloride and heavy metal (antimony, arsenic, cadmium, lead, mercury, silver, and zinc) even though a standard does not exist for these pollutants. Results indicate that incinerators 1, 2 and 3 are in compliance with applicable state standards. Incinerator 4 failed to meet standard with respect to visible and particulate emissions.

1252 (AD-A–209791/3/XAB) **Mercury vacuum cleaner operational test and evaluation.** Bennett, R.G. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Mar 1981. 26p. (USAFOEHL–81-09). Available from NTIS, PC A03/MF A01.

The Dental Investigation Service, USAFSAM, Brooks AFB, has outlined the need for a vacuum unit to be used in the Air Force dental clinics. The unit must be capable of effectively picking up

mercury and at the same time not redistribute mercury vapors throughout the dental clinic during normal operations or mercury-spill situations. The Dental Investigation Service selected the MRS-3, Minuteman Mercury Recovery System, product of American Cleaning Equipment Corporation as the mercury vacuum to be used for T&E. The USAF OEHL/ECH was requested by the Dental Investigation Service to perform the T&E on the MRS-3 for possible health hazards due to exposures of mercury vapors.

1253 (CONF-881097–1) **Executive overview of World Wildlife's conference on consequences of the greenhouse effect for biological diversity: Final project report.** Peters, R.L. World Wildlife Fund, Washington, DC (USA). [1988]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG01-87ER60605. From 1. conference on consequences of the greenhouse effect for biological diversity; Washington, DC (USA); 4-8 Oct 1988. Order Number DE89016803. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

World Wildlife Fund organized the first Conference on Consequences of the Greenhouse Effect for Biological Diversity, which was held October 4–6, 1988 at the National Zoological Park in Washington, DC. This meeting was the first to focus on how conservation of natural ecosystems would be effected by global warming. Prior to this meeting there existed no aggregated body of information about possible ecological effects, and very few scientists were doing relevant research or interpreting existing data in terms of climate change. Because effects had not been identified, biological diversity was largely overlooked in conferences and reports on global warming. Therefore, this conference had the groundbreaking role of pulling together existing information, stimulating scientists whose work could be relevant into focusing their efforts on global warming, drawing general conclusions about conservation consequences, and communicating these conclusions to the scientific, policy, funding, and management communities. 18 refs.

1254 (CONF-890526–2) **Evaluation of VOC (volatile organic compound) emissions from landfarming operations.** Cadena, F.; Fingleton, D.J.; Peters, R.W. Argonne National Lab., IL (USA). [1989]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 44. annual Purdue industrial waste conference; West Lafayette, IN (USA); 9-11 May 1989. Order Number DE90002196. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Volatile organic compound (VOC) emissions generated during landfarming of petrochemical wastes have come under scrutiny as sources of air pollution. The Thiboudeaux-Hwang (TH) model has been widely used to estimate VOC emissions from these area sources. This model offers distinct advantages over more-complex methods, but it ignores the effects of biodegradation, adsorption, and advective transport of soluble compounds in the water phase. Jury, Spencer, and Farmer (JSF) have presented a model for air emissions from area sources that accounts for these phenomena. Qualitative and quantitative comparisons between the TH and JSF models are presented. For conditions of no biodegradation, evapotranspiration, or leaching, the TH and JSF model results are comparable. The effect of adsorption of organic pollutants onto the organic fraction of the soil is minimal in the overall pollutant transport of the oily wastes. Depending on the biodegradation rate constants and exposure times, biodegradation may play an important role in the fate of the pollutant(s). The TH model predicts greater VOC emissions because it ignores biodegradation effects. Results obtained with the JSF model suggest that evapotranspiration enhances transport of soluble compounds to the soil surface (thus increasing air pollution emissions).

1255 (CONF-890563–3) **An integrated, long-term economic, energy-market and emissions policy model.** Fox, J.; Boyd, G.; Bloyd, C.; Miller, D.; Bando, A.; Edwards, B.; Hanson, D. Argonne National Lab., IL (USA). May 1989. 42p. Sponsored by U.S. DOE Environment Health & Safety; U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From CORS/TIMS/ORSA joint national meeting; Vancouver (Canada); 8-10 May 1989. Order Number DE90002201. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In 1980 the US Congress passed legislation creating the National Acid Precipitation Assessment Program (NAPAP), a 10-year research program. NAPAP is a multiagency effort and its organization includes an Interagency Science Committee, an Interagency Policy Committee, and seven task groups. The focus of this paper is on the NAPAP Integrated Model Set (IMS). The IMS must reflect the state-of-science in modeling and must be documented and compared with other approaches in the literature in a NAPAP State-of-Science report. The IMS has been developed for use in the NAPAP assessment planned for 1990. The components of the IMS include economic and energy scenario driver modules, sectoral energy use and emissions models, feedback loops, and integration connections. Each of the model components and the economic and energy drive modules and the integration approach have undergone third party review. 19 refs., 10 figs., 5 tabs.

1256 (CONF-890692–23) **Assessment of the importance of acidic fogwater and cloudwater in affecting terrestrial vegetation: Some important case studies.** Irving, P.M.; Eagar, C. Argonne National Lab., IL (USA). 1989. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, CA (USA); 25-30 Jun 1989. Order Number DE90002216. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this paper is to present some examples of terrestrial effects of concern as case studies to demonstrate the methodology to be used for answering questions of the NAPAP Integrated Assessment. The two examples presented, one each for forestry and crops, represent what is probably the "worst case" for possible acidic rain effects on crops and forests. Both examples revolve around hypotheses centering on stress from acidic fogwater or cloudwater. Because it is likely that additional information will become available prior to the publication of the Integrated Assessment, it should be understood that the analyses and interpretations presented on the following pages are subject to change when NAPAP publishes its final Assessment in 1990. 76 refs., 3 tabs.

1257 (CONF-8909243–1) **Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations.** Dale, V.H. Oak Ridge National Lab., TN (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Global natural resource monitoring and assessments: preparing for the 21st century; Venice (Italy); 24-30 Sep 1989. Order Number DE90001635. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Land use changes may be responsible for as much as 50% of the increase in atmospheric CO_2 that is thought to be causing climatic warming. The major cause of current land use is tropical deforestation. Estimating the rates of tropical deforestation is difficult, and, thus there is high uncertainty as to its contribution to atmospheric CO_2. Remote sensing data can provide an independent, relatively quick, and spatially disaggregated estimate of the amount of clearing that is occurring. 22 refs., 4 figs.

1258 (GKSS–89/E/14) **Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea.** Petersen, G.; Weber, H.; Grassl, H. GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 29p. Available from Special print from: J.M. Pacyna; B. Ottar (eds.): Control and fate of atmospheric trace metals, Kluwer, Dordrecht (Netherlands), p. 57-83 (1989).

Within the framework of a research contract with the German Federal Environmental Agency the long range transport of trace metals over Europe and the deposition of trace metals into the North Sea and the Baltic Sea are estimated using the EMEP- (European Monitoring and Evaluation Programme) trajectory model. The methodology for the model calculations is explained. Preliminary results for the total deposition of lead into the North Sea and the Baltic Sea show, that the calculated values are lower than previous estimates based on extrapolations from measurements at coastal sites and ship measurements in the southern Baltic Sea, respectively. (orig.).

1259 (N–89-17959) **Nitric acid oxide mixing ratio measurements using a rocket launched chemiluminescent instrument.**

Final technical report, September 1986-October 1987. Horvath, J.J. Michigan Univ., Ann Arbor, MI (USA). Jan 1989. 68p. (NASA-CR–182957;NAS–1.26:182957). Available from NTIS, PC A04/MF A01.

A total of 18 rocket launched parachute borne nitric oxide instruments were launched from 1977 to 1985. A very precise instrument for the measurement of the nitric oxide mixing ratio was fabricated. No changes were made in the main body of the instruments, i.e., things associated with the reaction volume. Except for the last 4 launches, however, it did not yield the required absolute values that was hoped for. Two major problems were encountered. First, the wrong choice of the background calibration gas, nitrogen, caused the first 10 data sets to be too low in the absolute mixing ratio by nearly the order of 2 to 5 ppbv. The error was realized, and air was substituted for the bias gas measurement. Second, in the desire to extend the measurement to higher altitudes, the problem of contaminating the inlet flow tube with ozone from the reagent gas was encountered. The ozone valve was opened too early in the flight and this caused the pressure in the reaction volume to exceed the pressure at the flow tube entrance, permitting the ozone to migrate backwards. This problem was restricted to an altitude above 45 km.

1260 (N–89-21287, pp. 19-20) **Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact.** Boston, P.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

One of the intriguing facets of the Cretaceous-Tertiary extinction is the apparently selective pattern of mortality amongst taxa. Some groups of organisms were severely affected and some remained relatively unscathed as they went through the K/T boundary. While there is argument concerning the exact interpretation of the fossil record, one of the best documented extinctions at the Cretaceous-Tertiary boundary is that of the calcareous nannoplankton. These organisms include coccolithic algae and foraminiferans. Attempts to explain their decline at the K/T boundary center around chemistry which could affect their calcium carbonate shells while leaving their silica-shelled cousins less affected or unaffected. Two environmental consequences of an extraterrestrial body impact which were suggested are the production of large quantities of nitrogen oxides generated by the shock heating of the atmosphere and the possible rise in CO2 from the dissolution of CaCO3 shells. Both of these phenomena would acidify the upper layers of the oceans and bodies of freshwater not otherwise buffered. The effects of nitric acid, carbon dioxide, or both factors on the growth and reproduction of calcareous marine coccoliths and non-calcareous marine and freshwater species of algae were considered. These experiments demonstrate that nitric acid and carbon dioxide have significant effects on important aspects of the physiology and reproduction of modern algae representative of extinct taxa thought to have suffered significant declines at the Cretaceous-Tertiary boundary. Furthermore, calcareous species showed more marked effects than siliceous species and marine species tested were more sensitive than freshwater species.

1261 (ORNL/FTR–3403) **[Managing the global environment]: Foreign trip report, September 9, 1989–September 23, 1989.** Rayner, S.F. Oak Ridge National Lab., TN (USA). 3 Oct 1989. 11p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90001396. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The conference was stimulated by concern that policy makers increasingly have to make environmental management decisions in the absence of solidly established scientific consensus about ecological processes and the consequences of human actions. Often, as in the case of climate change, some decisions may have to be made in the absence of information that is desirable but may not be available for years to come, if ever. Six topics were identified as running throughout the Congress. These were: the epistemology and history of the sciences or disciplines concerned with the environment, including the scientific basis of rationality and modes of dealing with uncertainty and complexity; the social, economic, and institutional conditions for the production of knowledge bearing on the environment, including the politics of research and the improvement of scientific data; the structuring and institutionalization of expert assessments on national and international levels, including the global distribution of expertise; the means of establishing scientific information, the role of the media in transmitting and processing knowledge about the environment, and the organization of public environmental debate; and decision making and management under conditions of uncertainty; and, finally the relationship between science and ethics. 13 refs.

1262 (ORNL/TM–11214) **Sampling and analysis protocols and project description for the Integrated Forest Study.** Lindberg, S.E.; Johnson, D.W.; Lovett, G.M.; Van Miegroet, H.; Taylor, G.E. Jr.; Owens, J.G. Oak Ridge National Lab., TN (USA). Aug 1989. 139p. Sponsored by U.S. DOE Energy Research; Electric Power Research Institute. DOE Contract AC05-84OR21400. Order Number DE90001857. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The principal objective of the Integrated Forest Study is to determine the effects of atmospheric deposition of major ions on forest nutrient cycling. The research has been conducted at forested sites in the northwestern, northeastern, and southeastern United States and in Canada and Norway. The sites selected for this study represent a range of conditions in climate, air quality, soils, and vegetation, which will facilitate testing hypotheses about the effects of atmospheric deposition on forest nutrient cycles. Research in the Integrated Forest Study is divided into two major sections: atmospheric deposition and forest nutrient dynamics. To assure comparability among data sets collected at each site, we developed a common set of protocols, which are described in detail in this report. 31 refs., 12 figs., 9 tabs.

1263 (PB–89-197917/XAB) **Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986.** Eggleston, H.S.; McInnes, G. Warren Spring Lab., Stevenage (UK). 1987. 80p. (LR–634(AP)M). Available from NTIS, PC EE06/MF E06.

Color illustrations reproduced in black and white.

This report describes the methods currently used in the United Kingdom to calculate emissions of carbon monoxide, sulfur dioxide, nitrogen oxide and volatile organic compounds on nationally and spatially disaggregated bases. Estimates of emissions for the years 1975 to 1985 are presented. The methods are under continual review to improve the accuracy and completeness of the emission estimates. Accuracy and the scope for development are discussed in the report and improvements will be presented in a series of annual reports to follow.

1264 (PB–89-197925/XAB) **Emission of nitrogen oxides from a Kuhlmann nitric acid plant.** Walker, D.S.; Stewart, R. Warren Spring Lab., Stevenage (UK). 1989. 26p. (LR–615(PA)M). Available from NTIS, PC EE05/MF E05.

An investigation of nitrogen oxide emission from a Kuhlmann nitric acid plant was carried out using a mobile emission laboratory equipped with continuous analyzers, for measuring nitrogen oxides and oxygen, and an extractive sampling system. The measurements were required to provide information for developing emission factors to be used in the compilation of UK Emission Inventories. This work is currently being carried out by Warren Spring Laboratory on behalf of the Department of the Environment. Details of the emission measurement results are given and comparisons are made with some published emission factors.

1265 (PB–89-198337/XAB) **United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987.** Gillham, C.A. Warren Spring Lab., Stevenage (UK). 1988. 47p. (LR–662(AP)M). Available from NTIS, PC EE05/MF E05.

Warren Spring Laboratory has for many years undertaken the collation and interpretation of data from up to 1200 stations monitoring black smoke and sulfur dioxide initially as part of the National Survey of Air Pollution. A review of UK urban monitoring requirements was carried out in 1981 resulting in approximately 500 sites continuing as part of the UK Smoke and Sulphur Dioxide Monitoring Networks. The report covers the re-organization of rural sites in the

UK Smoke and Sulphur Dioxide Monitoring Networks during the period of April 1986-March 1987, when the transition to centralized analysis took place. Future reports will consider results from the Basic Rural Network as a whole.

1266 (PB–89-212336/XAB) **Statistical treatment of CO_2 data records. Technical memo.** Elliott, W.P. National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab. May 1989. 142p. (NOAA-TM-ERL-ARL–173). Available from NTIS, PC A07/MF A01.

The report describes the selection processes used by NOAA/GMCC for selecting background hourly average CO_2 data from Mauna Loa Observatory. Selection involved three steps: a preliminary selection based on within hour variability of the CO_2 concentration determined by checking the analog output of the CO_2 analyzed on a strip chart recorder; an hour-to-hour concentration difference that rejects data which change by more than 0.25 ppm from one hour to the next; and a selection based on residuals from a spline fit. Examples are shown for the 1985 data, with emphasis on January and August.

1267 (PB–89-214027/XAB) **Quality-assurance procedures: Method 28A measurement of air-to-fuel ratio and minimum burn rate for wood-fired appliances.** Olin, R.C.; Rives, G.D.; Hartman, M.W.; Ward, T.E. Radian Corp., Research Triangle Park, NC (USA). Jul 1989. 219p. Available from NTIS, PC A10/MF A01.

Quality-assurance procedures are contained in the comprehensive document intended to be used as an aid for wood-heater manufacturers and testing laboratories in performing measurement of air-to-fuel ratio and minimum burn rate determinations according to EPA protocol, Method 28A. These procedures may be used in research and development, and as an aid in auditing and certification applicability testing. A detailed, step-by-step quality-assurance guide is provided to aid in the procurement and assembly of testing apparatus, to clearly describe the procedures, and to facilitate data collection and reporting. Suggested data sheets are supplied that can be used as an aid for both recordkeeping and certification applications. Throughout the document, activity matrices are provided to serve as a summary reference. Checklists are also supplied that can be used by testing personnel. Finally, for the purposes of ensuring data quality, procedures are outlined for apparatus operation, maintenance, and traceability. These procedures combined with the detailed description of the sampling and analysis protocol will help ensure the accuracy and reliability of Method 28A testing results.

1268 (PB–89-214142/XAB) **Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986.** Seila, R.L.; Lonneman, W.A.; Meeks, S.A. Computer Sciences Corp., Research Triangle Park, NC (USA). Mar 1989. 418p. Available from NTIS, PC A18/MF A01.

Currently more than 60 urban areas are not in compliance with the National Ambient Air Quality Standard (NAAQS) for ozone. The use of photochemical models will be necessary to forecast the nonmethane organic compound (NMOC) reductions needed to attain the NAAQS. These models require knowledge of the individual organic species in ambient air. To this end, speciated hydrocarbons were determined in over 800 ambient air samples obtained from 39 U.S. cities during 1984, 1985, and 1986. Whole-air samples were collected in electropolished, stainless steel spheres on weekdays from 6 to 9 A.M. during June through September each year. Two gas-chromatographic (GC) procedures with cryogenic sample preconcentration were employed to separate and measure C2 to C12 hydrocarbon species. Menu-driven software was developed to transfer GC data to a personal computer. The 48 compounds seen in highest concentration consisted of 25 paraffins, 15 aromatics, 7 olefins, and acetylene. Sample concentrations of the 64 most abundant species are reported.

1269 (PB–89-215859/XAB) **Respirable quartz exposure at silica flour producers, 1975-1986.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1988. 27p. Available from NTIS, PC A03/MF A01.

A study was conducted on respirable quartz exposures at silica flour producers for the period 1975-1986. In 1979, evaluations were performed at two silica-flour facilities in Illinois for the purpose of determining worker exposure to respirable quartz. It was evident that workers at both sites had a high incidence of silicosis. Continuing with the effort, visits were made to 28 silica-flour producers between 1975 and 1986. A total of 2,175 respirable quartz samples were examined and 52% of these exceeded the Mining Safety and Health Act (MSHA) Permissible Exposure Level (PEL). In 1984, 1985, and 1986, the percentages of samples taken which exceeded the PEL were 44, 46, and 34, respectively. The Recommended Exposure Level (REL) as established in NIOSH for pure respirable quartz limits exposure to a 10-hour time-weighted average level of 0.05mg/m^3. The percentage of samples of respirable quartz which exceeded this REL for the same time period were 74, 76, and 69, respectively. According to the authors, while the figures since 1979 do show the exposures to be dropping, there were still far more overexposures in this industry than in most other metal and nonmetal commodities. Without greater efforts to meet the levels required, the new cases of silicosis will continue to occur among workers in this industry.

1270 (PB–89-215958/XAB) **Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977.** Boeniger, M. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1977. 4p. (IWS–093.21). Available from NTIS, PC A02/MF A01.

An industrial-hygiene survey was conducted at Hanes Dye and Finishing Company, Winston-Salem, North Carolina on September 13-14, 1977 as part of a study on azo dyestuffs. The facility is engaged in textile dyeing, bleaching, filling, starching and calendering. Potential health hazards include excessive heat, steam, and dye misting in jigg dyeing areas, and dust exposure in the drug room. Recommendations to improve conditions are given.

1271 (PB–89-215982/XAB) **Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978.** Fan, S.; Fajen, J. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 27 Jun 1978. 24p. (IWS–072.20). Available from NTIS, PC A03/MF A01.

A survey was conducted at Crompton and Knowles Corp, Dyes and Chemicals Division, Reading, Pennsylvania, to determine whether N-nitroso compounds are contaminated in the azo dye factories, where sodium nitrite and sometimes secondary or tertiary amines are used as raw materials for dye synthesis. Seven air samples were collected and sampled through either midget impingers containing 15ml/1N KOH or vacuum traps containing 45ml/1N KOH at ambient temperature. At a detection limit of 0.5 micrograms/g, two raw materials samples, both chlorinated nitroanilines, were found to be thermal energy analyzer (TEA) responsive compounds. Three press cake-samples of the disperse dyes all contained a TEA-responsive compound at concentrations of 406, 3034, and 491 micrograms/g. TEA-response materials were found in every finished product of the disperse dyes.

1272 (PB–89-215990/XAB) **Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978.** Fan, S.; Fajen, J. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 21 Jun 1978. 13p. (IWS–072.19). Available from NTIS, PC A03/MF A01.

A survey was taken at Industrial Products Factory, Goodyear Tire and Rubber Company, Akron, Ohio to determine worker exposure to N-nitroso compounds, especially with regard to airborne volatile nitrosamines in the rubber industry. N-nitroso compound was not detected in any bulk samples at a detection limit of 0.5 micrograms/g. The carcinogen N-nitrosodimethylamine was identified by HPLC/TEA and confirmed by GC/TEA in all samples.

1273 (PB–89-216063/XAB) **Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973.** Zumwalde, R.D. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Field Studies and Clinical Investigations. 1 Oct 1973. 20p. (IWS–051.02.09). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

Two Federal Office Buildings in Washington, D.C., and one in Baltimore, Maryland were surveyed to determined if an airborne asbestos problem existed in any of the buildings that have asbestos-containing material used for fireproofing. The sampling strategy involved the collection of eight air and one bulk sample to establish the extent of asbestos exposures. The analysis of the bulk sample revealed that 90-95% of the material was fibrous glass, with the remaining being amosite asbestos. All measured fiber concentrations of the air samples were below 0.008 fibers per milliliter, and dispersion staining of the airborne samples indicated that less than 5% of the fibers collected were asbestos. The airborne levels were very low in comparison to OSHA occupational health standards. It is recommended that worker protection and appropriate handling procedures for any future demolition concerning the fireproofing material should be utilized.

1274 (PB–89-217723/XAB) **Maximal aerobic capacity at several ambient concentrations of carbon monoxide at several altitudes. Research report, April 1984-January 1988.** Horvath, S.M.; Agnew, J.W.; Wagner, J.A.; Bedi, J.F. California Univ., Santa Barbara, CA (USA). Environmental Stress Inst. Dec 1988. 36p. Available from NTIS, PC A03/MF A01.

To assess the combined effects of altitude and acute carbon monoxide exposure, 11 male and 12 female subjects, all nonsmokers in good health, were given incremental maximal aerobic-capacity tests. Each subject, after attaining the required altitude and ambient carbon monoxide level, performed the maximal aerobic capacity test. Blood samples were drawn at several points in the aerobic capacity test protocol, and analyzed for hemoglobin, hematocrit, plasma proteins, lactates, and carboxyhemoglobin. Carbonmonoxide-carboxyhemoglobin uptake rates were derived from the submaximal workloads. Despite increases in carboxyhemoglobin, no additional significant decreases in maximal aerobic capacity were observed. Immediately prior to and at maximal workloads, carbon monoxide shifted into extravascular spaces and returned to the vascular space within five minutes after exercise stopped.

1275 (PB–89-220511/XAB) **Trends of seasonal haziness and sulfur emissions over the eastern US.** Husar, R.B. Washington Univ., St. Louis, MO (USA). Center for Air Pollution Impact and Trend Analysis. Jun 1989. 31p. Available from NTIS, PC A03/MF A01.

The reduction in visual range in the eastern U.S. is caused largely by sulfate particles. Therefore, it is expected that the spatial distribution and temporal trend of man-made haziness will, to some extent, correspond to the spatial-temporal pattern of sulfur emissions. The purpose of the study is to examine the sulfur emission-haze relationship using regionally and seasonally disaggregated SO_2 emissions and visual-range data. Across much of the Northeast the wintertime haziness has been either declining or slightly increasing over the past three decades. The summertime haziness has been generally increasing in all areas of the eastern U.S. The monthly sulfur emissions for individual states were reconstructed using yearly emission trends and seasonal emission rates. Before 1970 winter emissions were greater but since the 1970's the summer emissions have become comparable in magnitude. These relationships may be used as a first indication of how visibility might change with changes in SO_2 emissions.

1276 (PB–89-861025/XAB) **Atmospheric modeling of air pollution. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 70p. Available from NTISPC N01/MF N01.

Supersedes PB–88-860853. See also PB–89-861017.

This bibliography contains citations concerning the development, validation, and application of mathematical models for air-pollution studies of mobile and stationary pollution sources. The models cover a wide range of mathematical complexity, utilizing factors such as terrain features, wake effects, diffusion, atmospheric stability, atmospheric wind, precipitation scavenging, gravitational deposition, atmospheric photochemistry, and urban heat islands. The models are used to support environmental-impact studies and effects of proposed emission-control strategies. Excluded are models of stratospheric pollution behavior, as applied to high-flying aircraft. (This updated bibliography contains 105 citations, all of which are new entries to the previous edition.)

1277 (PB–89-869382/XAB) **Carbon dioxide and climate. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 163p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868179.

This bibliography contains citations concerning the relationship between changes in carbon dioxide in the atmosphere and changes in the climate. Topics include the greenhouse effect, global climatic models, and climatic effects from combustion of fossil fuels. (This updated bibliography contains 309 citations, 55 of which are new entries to the previous edition.)

1278 (PB–89-869390/XAB) **Carbon dioxide and climate. January 1970-July 1989 (Citations from Pollution Abstracts). Report for January 1970-July 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 66p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868468.

This bibliography contains citations concerning research, observations, and analyses of the relationship between changes in carbon dioxide in the atmosphere and changes in the climate. Topics include the greenhouse effect, global climatic models, and climatic effects from combustion of fossil fuels. Monitoring of carbon dioxide is reported for global observations and special polar-region observations. Some studies relate to identifying anthropogenic causes of the variations from those due to natural sources, such as plants and the ocean reservoir. (This updated bibliography contains 152 citations, 60 of which are new entries to the previous edition.)

1279 (UCRL–21214-Vol.4) **Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation.** Neff, D.E. Lawrence Livermore National Lab., CA (USA); Colorado State Univ., Fort Collins, CO (USA). Fluid Mechanics and Wind Engineering Lab. Jun 1989. 17p. DOE Contract W-7405-ENG-48. Order Number DE90001103. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Accidental releases of pressurized, superheated hydrogen fluoride (HF) can result in initially dense clouds which will typically contain a mixture of HF vapor, aerosol, and droplets. Previous experiments were performed by Amoco Oil Company and Lawrence Livermore National Laboratories (the Goldfish series in 1986) to study atmospheric dispersion of these HF clouds. The present study examines the effect of water application on the mitigation of these clouds. To assess the effectiveness of water application (via either sprays or monitor) in mitigating HF clouds two series of tests were conducted in separate flow chambers. Bench scale experiments identified key variables for testing in a larger facility. The large scale field tests demonstrated that HF releases can be mitigated with water. The impact of numerous design variables on mitigation effectiveness has also been quantified. HF removal efficiencies of 25 to 90+% have been demonstrated at water to HF liquid ratios of 6/1 to 40/1 and higher.

1280 (UCRL–101736) **Quantifying the link between change in radiative balance and atmospheric temperature.** McCracken, M.C. Lawrence Livermore National Lab., CA (USA). Aug 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8904276–1: DOE carbon dioxide research program workshop, Germantown, MD (USA), 24-25 Apr 1989). Order Number DE90000819. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There has been a seemingly increasing divergence between the observed warming of about 0.5°C over the past 100 years and the estimates of the most recent climate model simulations that a doubling of the carbon dioxide concentration will lead to an increase in global average temperatures of perhaps 1.5 to 5°C. While there are many factors to consider in attempting to reconcile these different quantities (e.g., ocean thermal lag, atmospheric composition changes, volcanic aerosols, etc.), the level of uncertainty in estimates of future climate change clearly needs to be reduced. The purpose of this workshop was to solicit scientific counsel as part of

the process of developing a new research effort to quantify the link between increasing greenhouse gases and climate change. This program of research would stress observations, field experiments and laboratory approaches as a means of resolving the apparent inconsistencies between the climate model predictions of the expected climate change to date and the observed climate system, as well as seeking to reduce the large uncertainties evident in recent studies of the treatment of cloud feedbacks. The objective of the workshop was to review the state-of-the-art for measuring the radiative balance and to explore possible experiments to link the cause and effect from changes in atmospheric composition to atmospheric temperature and other measures of climate change.

1281 **Experimental design of the 1984 ASCOT field study*.** Clements, W.E. (Los Alamos National Laboratory, Los Alamos, New Mexico (US)); Archuleta, J.A.; Gudiksen, P.H. *Journal of Applied Meteorology (USA)*, 28(6): 405-413 (Jun 1989).

During September and October 1984 the Department of Energy's Atmospheric Studies in Complex Terrain program conducted an intensive field study in the Brush Creek Valley of western Colorado. The overall objective of the study was to enhance the understanding of pollutant transport and diffusion associated with valley flows. Data collections were designed to investigate nocturnal and morning transition wind, turbulence, and temperature fields in the valley, in its tributaries, and on its side-slopes, and how these are affected by the free stream conditions above the valley. The release and sampling of atmospheric tracers were used to study transport and diffusion. The experimental design of this study is presented. ©1989 American Meteorological Society

5003 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 159, 524, 525, 527, 535, 536, 684

1282 (EGG-ESE–8600) **Methodology for assessing the radiological consequences of radioactive releases from the CIT [Compact Ignition Tokamak] facility at PPPL [Princeton Plasma Physics Laboratory].** McKenzie-Carter, M.A.; Lyon, R.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 77p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002229. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

This report contains information to support the Environmental Assessment for the Compact Ignition Tokamak Project (CIT) proposed for Princeton Plasma Physics Laboratory (PPPL). The assumptions and methodology used to assess the impact to members of the public from operational and accidental releases of radioactive material from the proposed CIT during the operational period of the project are described. A description of the tracer release tests conducted at PPPL by NOAA is included; dispersion values from these tests are used in the dose calculation. Radiological releases, doses, and resulting health risks are calculated. The computer code AIRDOS-EPA is used to calculate the individual and population doses for routine releases; FUSCRAC3 is used to calculate doses resulting from off-normal releases where direct application of the NOAA tracer test data is not practical. Where applicable, doses are compared to regulatory limits and guidelines values. 44 refs., 5 figs., 18 tabs.

1283 (INIS-BR–1624, pp. 98) **Radon measurements in the Amazon region (GTE-ABLE2B, April-May, 1987).** Nordemann, D.J.R.; Pereira, E.B. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. RADON 222/isotope ratio; RADON 222/troposphere; AEROSOLS; ALPHA SPECTROSCOPY; LEVELS; PARTICLES; TROPOSPHERE

1284 (LA–11672-PR) **Health, Safety, and Environment Division annual report, 1988.** Rosenthal, M.A. (comp.). Los Alamos National Lab., NM (USA). Oct 1989. 133p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. Order Number DE90001778. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The primary responsibility of the Health, Safety, and Environment (HSE) Division at the Los Alamos National Laboratory is to provide comprehensive occupational health and safety programs, waste processing, and environmental protection. These activities are designed to protect the worker, the public, and the environment. Many disciplines are required to meet the responsibilities, including radiation protection, industrial hygiene, safety, occupational medicine, environmental science, epidemiology, and waste management. New and challenging health and safety problems occasionally arise from the diverse research and development work of the Laboratory. Research programs in HSE Division often stem from these applied needs. These programs continue but are also extended, as needed, to study specific problems for the Department of Energy and to help develop better occupational health and safety practices. 52 refs.

1285 (ORNL/FTR–3402) **[Environmental transport of radionuclides]: Foreign trip report, September 14–26, 1989.** Hoffman, F.O. Oak Ridge National Lab., TN (USA). 11 Oct 1989. 41p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001493. Available from NTIS, PC A03/MF A01 - OSTI.

The objective of the trip was to obtain a signed memorandum of cooperation with the Soviet Union on research topics of mutual interest with regard to the rapid assessment of radioactivity released to the environment from reactor accidents. The traveler was requested to represent the issues of uncertainty analysis and model validation. The signing of a Memorandum of Meeting occurred on September 22, 1989, in Moscow between Dr. Murray Schulman. DOE/OHER, and representatives of the USSR Institute of Hydrometeorology and the USSR Academy of Sciences. This memorandum outlined areas of research in atmospheric dispersion and deposition as well as the transport, fate, and effect of radionuclides in terrestrial, aquatic, and urban environments. The ultimate purpose of this research would be to improve the capability in both countries to rapidly forecast the potential consequences of nuclear reactor accidents. Soviet scientists are eager to participate in collaborative research with the United States, especially if such collaboration would expedite their procurement of scientific equipment.

1286 (WSRC-RP–89-388) **Model evaluation studies.** Addis, R.P.; Bunker, S.S.; Dobosy, R.J.; Lange, R.; Porch, W.M. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8905148–2: 2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from nuclear installations, Leuembourg (Netherlands), 16-19 May 1989). Order Number DE89 007843. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Office of Health and Environmental Research (OHER) of the US Department of Energy (DOE) sponsors an ongoing series of atmospheric field studies whose main objectives are to increase fundamental knowledge of atmospheric transport and dispersion. This knowledge is used to develop technologies and methodologies required for both air quality assessments and real-time emergency response. These field studies have ranged from point releases of tracers in relatively simple terrain, to intensive field studies in extremely complex terrain. Scales have ranged from the mesoscale to the synoptic. This paper will give an overview of several DOE/OHER sponsored field experiments with particular emphasis on the role they have played in helping to improve and evaluate real-time atmospheric transport and dispersion models. The Mesoscale Atmospheric Transport Studies (MATS) and STable Atmospheric Boundary Layer Experiment (STABLE), conducted at Savannah River Site in South Carolina, have provided valuable data for model evaluation over gently rolling forested terrain. In contrast, the extensive series of Atmospheric Studies in COmplex Terrain (ASCOT) involve experiments in the extremely complex terrain of the Geysers area of northern California and Brush Creek in Colorado. Remote sensing has played a significant role in ASCOT in providing meteorological parameters for input into models. The vital role played by

models in the initial design of these experiments will also be discussed. 41 refs., 3 figs., 1 tab.

5005 Site Resource and Use Studies

1287 Influence of external meteorology on nocturnal valley drainage winds. Barr, S. (Los Alamos National Laboratory, Los Alamos, New Mexico (US)); Orgill, M.M. *Journal of Applied Meteorology (USA)*, 28(6): 497-517 (Jun 1989).

Thermally driven local circulation in valleys has been studied for many years with the result that the underlying physics are reasonably well understood. The ASCOT experiments of the early 1980s were formulated to help quantify predictive models and to apply the resulting methods to transport and dispersion of airborne materials. During the performance and analysis of experiments in two quite different valleys, it became clear that important aspects of the structure of the valley circulation depend on subtle differences in the ambient atmospheric conditions. In this paper we interpret nocturnal drainage structure in terms of ambient characteristics. We are able to describe changes in the depth of drainage and volume flux in terms of the influence of external wind and radiative effects on the collection of cool air in a valley airshed, and on erosion of an established drainage by turbulent entrainment. We describe evidence for internal buoyancy waves and rotors that can have a major effect on transport and dispersion in the nocturnal cool-air drainage regime. Under ideal conditions of radiative cooling and light ambient winds the drainage depth fills the valley to the ridge level. The radiative driving factor is strongly suppressed by low cloud ceilings and this is reflected in drainage depths shallower than 25% of the valley depth. Further erosion of cold air drainage by turbulent entrainment of ambient air under conditions of moderate to strong ridge top winds results in a linear regression of the form: $H/H_0=(1-0.068\nu)$, where ν is the ridge top wind in m s^{-1}.

5006 Regulations

Refer also to citation(s) 42, 719, 740, 1299, 1300, 1359

1288 (PB–89-138002/XAB) **In-situ emission factors for residential wood-combustion units. Final report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Dec 1988. 45p. (EPA–450/3-88/013). Available from NTIS, PC A03/MF A01.

The report presents particulate emission factors (grams per hour, grams per kilogram) for existing traditional-technology woodstoves and catalytic and noncatalytic units which meet or could meet the Environmental Protection Agency's 1988 new source performance standards.

1289 (PB–89-139190/XAB) **National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Sep 1988. 1743p. (EPA–450/4-88/018). Available from NTISMF A01.

See also PB–86-114659.

The National Emissions Report summarizes annual cumulative estimates of source emissions of five criteria pollutants: particulates, sulfur oxides, nitrogen oxides, volatile organic compounds, and carbon monoxide. Source emissions data are reported to the U.S. Environmental Protection Agency under provisions of Section 110 of the Clean Air Act, as amended 1977, and EPA regulations, Title 40, Code of Federal Regulations, Part 51.321. Summary data are presented for the Nation as a whole, for individual States, and for Air Quality Control Regions and for individual interstate portions thereof. The data compilations result from the operations of the National Emissions Data System (NED), which functions as a component of the comprehensive EPA air information system–the Aerometric and Emissions Reporting System (AEROS). AEROS is managed by the National Air Data Branch, Emissions Standard Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, at Research Triangle Park, North Carolina.

1290 (PB–89-212278/XAB) **Using jobs/housing balance indicators for air-pollution controls. Master's thesis.** Livingston, B.L. California Univ., Berkeley, CA (USA). Graduate School of Public Policy. 10 May 1989. 59p. Available from NTIS, PC A04/MF A01.

This study assists air-quality planners at the regional, state, and federal level in the use of Jobs/Housing (J/HB) balance indicators. It examines the J/HB indicator as a tool in developing measures to reduce commuting distances by better placement of jobs and housing. An area is said to have a balance of jobs and housing if housing is available to workers within a reasonable commuting distance and at a price affordable to those workers. Reducing the distance, time and number of commuting trips can decrease mobile-source air pollution and therefore improve air quality. Two types of Jobs/Housing balance indicators, the 'ratio' and the 'range' are defined and critiqued. The study offers a methodology for planners in applying the J/H range to the development of sites that are rich in jobs but poor in housing. The study also presents examples of land-use control measures which are of use to regional and local government planners.

1291 S. 585: A bill Pollution Prevention Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 14, 1989. 22p. Government Printing Office, Washington, DC (US) (1989).

A bill has been introduced in the Senate to implement the national objective of pollution prevention by establishing a source reduction program at the EPA, by assisting states in providing information and technical assistance regarding source reduction, and other purposes.

1292 S. 657: A bill Indoor Air Quality Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989. 54p. Government Printing Office, Washington, DC (US) (1989).

A bill has been introduced in the Senate to authorize a national program to reduce the threat to human health posed by exposure to contaminants in indoor air. Recent studies indicate that pollutants in the indoor air include radon, asbestos, volatile organic chemicals, metals and gases, respirable particles, tobacco smoke, biological contaminants, microorganisms, and other contaminants.

1293 S. 503: A bill Chlorofluorocarbons and Halon Reduction Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989. 12p. Government Printing Office, Washington, DC (US) (1989).

A bill has been introduced in the Senate to protect the ozone layer by reducing chlorofluorocarbons and halons. The objective of this Act is to provide for a smooth transition away from the use of ozone-depleting chemical in order to protect the earth's ozone layer and to limit global warming. In order to achieve this objective, the national goal is to provide for an orderly and equitable shift to alternative chemicals and products and of facilitate the competitiveness of United States industry at home and abroad.

1294 S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989. 31p. Government Printing Office, Washington, DC (US) (1989).

A bill has been introduced in the Senate to reduce atmospheric pollution to protect the stratosphere from ozone depletion which is mainly caused by chlorofluorocarbons, halons, methane, nitrous oxide, and carbon dioxide.

1295 H.R. 5032: A bill Acid Rain/Energy Security Initiative Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988. 27p. Government Printing Office, Washington, DC (US) (1988).

A bill was introduced in the House of Representatives to amend the Clean Air Act to better control sources of acid deposition, to assist states with the costs of controlling major sources. One of the goals of this Act is to reduce the annual emissions of sulfur dioxide from utility sources and nitrates from stationary sources.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

Refer also to citation(s) 172

5102 Chemicals Monitoring and Transport

Refer also to citation(s) 93, 724, 734, 735, 1325, 1330

1296 (CONF-891057–2) **Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base.** Dearborn, L.L.; Baker, P.S.; Davis, J.B. Oak Ridge National Lab., TN (USA). 1989. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From 3. international symposium on borehole geophysics; Las Vegas, NV (USA); 2-5 Oct 1989. Order Number DE90001337. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent hydrogeologic investigations at Loring Air Force Base (AFB) in Limestone, Maine, showed that subsurface data provided by borehole geophysical logging and subsequently installed custom-designed multilevel monitoring wells greatly complement each other in understanding contaminant migration pathways in bedrock. Based on interpretations of borehole geophysical suites, four wells drilled into undifferentiated limestone were equipped with Westbay packer/port units. Individual hydraulic testing and chemical sampling of as many as 10 depth intervals per well resulted in a spatial distribution of hydraulic conductivity, groundwater head, and contaminant concentration values that were difficult to integrate into a conceptual model. The comparison of these data with borehole logging data allowed development of a conceptual understanding of the lithologic structure, and subsequently groundwater movement. The normal resistivity logs were found to be the most important. 8 refs., 12 figs.

1297 (CONF-8909232–1) **Hazardous waste research and development in the Pacific Basin.** Cirillo, R.R.; Carpenter, R.A. Argonne National Lab., IL (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 8. Japan - United States Governmental conference on solid waste management; Honolulu, HI (USA); 6-7 Sep 1989. Order Number DE90001431. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The effective management of hazardous waste is an issue that all countries of the Pacific Basin must address. By very rough estimates, almost 272 million metric tons of hazardous wastes are being generated every year in the region. While the data are not consistently defined and reported, they do indicate the extent of the problem. Increasing development brings along an increase in the rate of hazardous waste generation. On this basis, the developing countries of the region can be expected to experience some of the same problems of the developed countries as their economies become more industrialized. Fundamental problems are involved in the compilation of consistent hazardous-waste generation statistics in the Pacific Basin. One involves the definition of what constitutes hazardous waste.

1298 (EGG-ER–8623) **Contaminant transport in the Snake River Plain Aquifer: Phase 1, Part 1: Simple analytical model of individual plumes.** Rood, A.S.; Arnett, R.C.; Barraclough, J.T. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1989. 48p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002232. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A preliminary, semi-quantitative assessment of the migration of INEL effluents in the Snake River Plain Aquifer (SRPA) was performed. This study focused on past tritium, ^{129}I, and ^{90}Sr effluents from the Idaho Chemical Processing Plant (ICPP) and Test Reactor Area (TRA) and carbon tetrachloride from the Radioactive Waste Management Complex (RWMC). The disposal ponds at TRA and the ICPP injection well were the primary means of liquid radioactive waste discharge from the ICPP and TRA. Drums containing solidified chlorinated solvents disposed of at the RWMC were the primary source of carbon tetrachloride. Water samples taken from wells located in the SRPA show detectable quantities of the four contaminants. The predicted radionuclide concentrations exceed drinking water limits in limited areas within the INEL boundaries. Without planned remedial action, carbon tetrachloride is predicted to exceed drinking water limits beyond the site boundaries near the middle of the next century. 16 refs., 23 figs., 3 tabs.

1299 (ORNL–6526/R7) **Environmental regulatory update table.** Houlberg, L.M.; Langston, M.E.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Sep 1989. 109p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90000961. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

1300 (ORNL–6526/R8) **Environmental Regulatory Update Table, September 1989.** Houlberg, L.M.; Langston, M.E.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Oct 1989. 105p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90000962. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

1301 (ORNL/FTR–3411) **[Global natural resource monitoring and assessment]: Foreign trip report, September 23–October 7, 1989.** Dale, V.H. Oak Ridge National Lab., TN (USA). 16 Oct 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001294. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler participated in a major international forestry conference in Venice, Italy, and gave a presentation on the need for monitoring forests on a worldwide basis and a strategy to do so. She also participated in a working group on ways to promote institutional collaboration for global monitoring. Observations from this conference are summarized with focus on issues relating to Oak Ridge National Laboratory's (ORNL's) Center for Global Environmental Studies. The traveler also discussed the possibility of a joint ORNL-Swiss research program to develop a spatial model of forests.

1302 (ORNL/TM–11294) **Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation.** Lee, R.R.; Ketelle, R.H.; Bownds, J.M.; Rizk, T.A. Oak Ridge National Lab., TN (USA). Sep 1989. 219p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90000982. Available from NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

A groundwater flow and contaminant transport model calibration was performed to evaluate the ability of a typical, verified computer code to simulate groundwater tracer migration in the shallow aquifer of the Conasauga Group. Previously, standard practice site data interpretation and groundwater modeling resulted in inaccurate simulations of contaminant transport direction and rate compared with tracer migration behavior. The site's complex geology, the presence of flow in both fractured and weathered zones, and the transient character of flow in the shallow aquifer combined to render inaccurate assumptions of steady-state, homogeneous groundwater flow. The improvement of previous modeling results required iterative phases of conceptual model development, hypothesis testing, site field investigations, and modeling. The activities focused on generating a model grid that was compatible with site hydrogeologic conditions and on establishing boundary conditions based on site

data. An annual average water table configuration derived from site data and fixed head boundary conditions was used as input for flow modeling. The contaminant transport model was combined with the data-driven flow model to obtain a preliminary contaminant plume. Calibration of the transport code was achieved by comparison with site tracer migration and concentration data. This study documents the influence of fractures and the transient character of flow and transport in the shallow aquifer. Although compatible with porous medium theory, site data demonstrate that the tracer migration pathway would not be anticipated using conventional porous medium analysis. 126 figs., 22 refs., 5 tabs.

1303 (PNL–6930) **Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill.** Fruland, R.M. Pacific Northwest Lab., Richland, WA (USA). Oct 1986. 76p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90001499. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Washington state regulations required that solid waste landfill facilities have ground-water monitoring programs in place by May 27, 1987. This document describes the well locations, installation, characterization studies and sampling and analysis plan to be followed in implementing the ground-water monitoring program at the Hanford Site Solid Waste Landfill (SWL). It is based on Washington Administrative Code WAC 173-304-490. 11 refs., 19 figs., 4 tabs.

1304 (WHC-SP–0193) **300 Area process trench sediment analysis report.** Zimmerman, M.G.; Kossik, C.D. Westinghouse Hanford Co., Richland, WA (USA). Dec 1987. 260p. Sponsored by U.S. DOE Defense Programs; U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90001260. Available from NTIS, PC A12/MF A01 - OSTI.

This report describes the results of a sampling program for the sediments underlying the Process Trenches serving the 300 Area on the Hanford reservation. These Process Trenches were the subject of a Closure Plan submitted to the Washington State Department of Ecology and to the US Environmental Protection Agency in lieu of a Part B permit application on November 8, 1985. The closure plan described a proposed sampling plan for the underlying sediments and potential remedial actions to be determined by the sample analyses results. The results and proposed remedial action plan are presented and discussed in this report. 50 refs., 6 figs., 8 tabs.

1305 (WSRC-RP–89-822) **Savannah River Laboratory Seepage Basins: Waste site assessment report.** Haselow, J.S.; Looney, B.B.; Nichols, R.L. Westinghouse Savannah River Co., Aiken, SC (USA). 5 Sep 1989. 298p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90001284. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

This Waste Site Assessment for the SRL Seepage Basins is the second in a series of documents being prepared to support development of an appropriate closure plan for these basins. The closure of these basins will be designed to provide protection to human health and the environment and to meet the provisions of the Consent Decree. A Technical Data Summary for these basins has already been submitted as part of the Consent Decree. This Site Assessment Report includes a waste site characterization, and a discussion of closure options for the basins. A closure option is recommended in this report, but details of the recommended closure are not provided in this report since they will be provided in a subsequent closure plan. The closure plan is the third document required under the Consent Decree. 18 refs., 16 figs., 10 tabs.

1306 **Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies.** Johnson, D.W. (Oak Ridge National Lab., TN (USA)); Todd, D.E. *Soil Science Society of America Journal (USA)*, 52(5): 1468-1477 (Sep-Oct 1988). DOE Contract AC05-84OR21400.

Loblolly pine (Pinus taeda L.) and yellow poplar (Liriodendron tulipifera L.) seedlings from 1-10 seedling stock were established in the Tennessee Valley near Oak Ridge and fertilized with 300 kg ha^{-1} of urea-N over a period of 3 yr according to two regimes: annually in one spring application and quarterly. Two plantation blocks for each species, one consisting of seedlings preinoculated with mycorrhizae and one without preinoculation, contained three replicate plots per treatment. Annual fertilization produced greater growth and N recovery in both loblolly pine plantations than did quarterly fertilization, the latter not being significantly different from the controls. Growth responses in yellow-poplar plantations were less certain and not statistically significant, probably due to moisture stress for this species on this site. There was no evidence of prolonged (>2 yr) enhancement of soil available N following either quarterly or annual fertilization. Quarterly fertilization produced the earliest and generally the most pronounced increases in soil solution NO_3^- concentrations in all cases, followed by annual fertilization and control, respectively. These results, combined with laboratory incubations, indicated that quarterly fertilization benefited the nitrifying bacteria more than the trees on this site, particularly in the case of loblolly pine.

5103 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 150, 171, 200, 504, 524, 525, 527, 535, 536, 1228, 1231, 1285, 1334

1307 (BMU–1988-198) **Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie. Jun 1988. 123p. (In German). Contract BMU St.Sch. 702a. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Transfer in a large number of plants cultivated in agriculture and partly in gardening was studied in lysimeter experiments under field conditions. Two soil types were used in the experiments: para brown earth and podzol. The experiments were accompanied by pot experiments under standardised conditions in greenhouses and by small-scale pot experiments in air-conditioned chambers, with the aim of testing the transferability of the results of such experiments to real field situations. In the lysimeter experiments, a distinction was made between soil situation after 50 years of continuous cultivation - working of radionuclides into the 0-20 cm topsoil layer - and accidental situations - regular working into the 0-1 cm topsoil layer. In a special experiment the deposition of a high single emission was simulated by direct application to the soil surface under grassland vegetation, or by overhead irrigation on pasture grass and summer barley after ear emergence. Moreover, in a pot experiment repeated eight times, the variation of the transfer factors in their dependence on soil properties was studied with the help of 10 soil types from the surroundings of the nuclear power stations of Stade and Biblis. (orig./HP).

1308 (ORNL/RASA–87/32) **Results of the radiological survey at 7 Hancock Street, Lodi, New Jersey (LJ027).** Cottrell, W.D.; Floyd, L.M.; Francis, M.W.; Mynatt, J.O. Oak Ridge National Lab., TN (USA). Sep 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001560. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. AT the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 7 Hancock Street, Lodi, New Jersey (LJ027), was conducted during

1985 and 1986. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 5 refs., 5 figs., 3 tabs.

1309 (ORNL/RASA–87/33) **Results of the radiological survey at 5 Hancock Street, Lodi, New Jersey (LJ029).** Cottrell, W.D.; Floyd, L.M.; Francis, M.W.; Mynatt, J.O. Oak Ridge National Lab., TN (USA). Sep 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001486. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 5 Hancock Street, Lodi, New Jersey (LJ029), was conducted during 1985 and 1986. Results of the survey demonstrated concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of the material originating from the MCW site. 5 refs., 6 figs., 3 tabs.

1310 (ORNL/RASA–87/35) **Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048).** Cottrell, W.D.; Floyd, L.M.; Francis, M.W.; Mynatt, J.O. Oak Ridge National Lab., TN (USA). Aug 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002130. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 24 Long Valley Road, Lodi, New Jersey (LJ048), was conducted during 1985 and 1986. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 4 refs., 8 figs., 3 tabs.

1311 (ORNL/RASA–88/25) **Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060).** Foley, R.D.; Carier, R.F.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Sep 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001589. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 4 Hancock Street, Lodi, New Jersey (LJ060), was conducted during 1985 and 1986. Gamma logging results found during this survey and during a previous survey conducted by Bechtel National, Incorporated, strongly indicated radionuclide concentrations in subsurface soil in excess of DOE remedial action criteria. This finding, coupled with the fact that adjacent properties have been found to be contaminated and that Lodi Brook apparently flows under the property, suggests that it be considered for inclusion in the DOE remedial action program. 5 refs., 4 figs., 4 tabs.

1312 (ORNL/RASA–88/39) **Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074).** Foley, R.D.; Carrier, R.F.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Sep 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002134. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurements of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site located at the intersection of Main Street and Highway 46, Lodi, New Jersey (LJ074), was conducted during 1987. While some radiological measurements taken at the vacant lot at the intersection of Main Street and Highway 46 were greater than background levels typically encountered in the northern New Jersey area, no radiation levels nor radionuclide concentrations exceeded the applicable DOE criteria. The survey results demonstrate that the radiological condition of this property conforms to DOE guidelines for remedial action. 4 refs., 5 figs., 3 tabs.

1313 (ORNL/RASA–88/51) **Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021).** Foley, R.D.; Cottrell, W.D.; Floyd, L.M. Oak Ridge National Lab., TN (USA). Sep 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001280. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey

typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), was conducted during 1986. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 5 refs., 2 figs., 3 tabs.

1314 (ORNL/RASA–88/55) **Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062).** Foley, R.D.; Cottrell, W.D.; Floyd, L.M. Oak Ridge National Lab., TN (USA). Jul 1989. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002131. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), was conducted during 1986 and 1987. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 4 refs., 4 figs., 3 tabs.

1315 (ORNL/RASA–88/56) **Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063).** Foley, R.D.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Jul 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002129. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 106 Columbia Lane, Lodi, New Jersey (LJ063), was conducted during 1987. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 4 refs., 7 figs., 3 tabs.

1316 (ORNL/RASA–88/58) **Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066).** Foley, R.D.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Aug 1989. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002133. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of the gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, the Firemen's Memorial Park and Fire Hall #2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066) was conducted during 1987. Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site. 4 refs., 10 figs., 3 tabs.

5105 Site Resource and Use Studies

Refer also to citation(s) 49, 1303

1317 (CONF-8904232–2) **Siting industrial waste land disposal facilities in Thailand: A risk based approach.** Fingleton, D.J.; Habegger, L.; Peters, R.; Tomasko, D.; Liengcharernsit, W.; Hastings, P.; Boonraksa, C.; Phantumvanit, D.; Smith, K.; Carpenter, R. Argonne National Lab., IL (USA). [1989]. 26p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From Pacific basin conference on hazardous waste; Singapore (China); 2-7 Apr 1989. Order Number DE90002271. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Thailand Industrial Works Department (IWD) has established a toxic industrial waste Central Treatment and Stabilization Center (CTSC) for textile dyeing and electroplating industries located in the Thonburi region of the Bangkok metropolitan area. Industrial waste is treated, stabilized, and stored at the CTSC. Although the IWD plans to ship the stabilized sludge to the Ratchaburi Province in western Thailand for burial, the location for the land disposal site has not been selected. Assessing the relative health risks from exposure to toxic chemicals released from an industrial waste land disposal site is a complicated, data-intensive process that requires a multidisciplinary approach. This process is further complicated by the unique physical and cultural characteristics exhibited by the rapidly industrializing Thai economy. The purpose of this paper is to describe the research approach taken and to detail the constraints to health risk assessments in Thailand. issues discussed include data availability and quality, effectiveness of control or mitigation methods, cultural differences, and the basic assumptions inherent in many of the risk assessment components.

1318 (EGG-M–89063) **Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory.** McElroy, D.L.; Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890928–10: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90002057. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A network of vadose zone instruments was installed in surficial sediments and sedimentary interbeds beneath the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory. The network of instruments monitor moisture movement in a heterogeneous geologic system comprised of sediments which overlie and are intercalated with basalt flows. The general range of matric potentials in the surficial sediments (0 to 9.1 m) was from saturation to –3 bars. The basalt layer beneath the surficial sediments impedes downward water movement. The general range of matric potentials in the 9-, 34- and 73-m interbeds

was from −0.3 to 1.7 bars. Preliminary results indicated downward moisture movement through the interbeds. 8 refs., 9 figs., 1 tab.

1319 (WHC-SA–0606) **Natural phenomena analyses, Hanford Site, Washington.** Tallman, A.M. Westinghouse Hanford Co., Richland, WA (USA). Sep 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910192–12: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90000112. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Site has been the subject of numerous natural hazard studies. These studies have supported the siting and construction of nuclear reactors, the siting and characterization of a potential high-level nuclear waste repository, the routine operation of process facilities, and waste management. The natural hazard models resulting from these studies are compared to the models promulgated by the Lawrence Livermore National Laboratory for use in the design and evaluation guidelines for US Department of Energy facilities. Probabailistic seismic hazard studies completed for the Washington Public Power Supply System's Nuclear Plant 2 and for the US Department of Energy's N Reactor sites, both on the Hanford Site, suggested that the Lawrence Livermore National Laboratory seismic exposure estimates were lower than appropriate, especially for sites near potential seismic sources. A probabilistic seismic hazard assessment was completed for those areas that contain process and/or waste management facilities. The lower bound magnitude of 5.0 is used in the hazard analysis and the characteristics of small-magnitude earthquakes relatively common to the Hanford Site are addressed. 24 refs., 4 figs., 2 tabs.

1320 (WINCO–1069) **The evolution of seismic design criteria at the Idaho Chemical Processing Plant.** Uldrich, E.D.; Dahlke, H.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA). Sep 1989. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE90001861. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The geology and seismology of the INEL have been extensively studied and the criteria used for seismic design of INEL facilities have evolved based on the results of these studies and on the development of national standards, codes and regulations. Existing facilities at the ICPP have been constructed using the seismic requirements in effect at the time of design. Based on available information, the current criteria are felt to be conservative. It is important that reasonable, defendable criteria be available for the design of new facilities such as the Special Isotope Separation Project and the New Production Reactor. 22 refs., 7 figs.

5106 Regulations

Refer also to citation(s) 39, 41, 73, 1291, 1353, 1356, 1358

1321 (PB–89-212757/XAB) **Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989.** Raghaven, R.; Coles, E.; Dietz, D. Foster Wheeler Enviresponse, Inc., Livingston, NJ (USA). Jun 1989. 82p. Available from NTIS, PC A05/MF A01.

This report presents a state-of-the-art review of soil-washing technologies and their applicability to Superfund sites in the United States. The review includes Superfund site soil and contamination characteristics, as well as soil cleaning technologies, their principles of operation, and process parameters. The technical feasibility of using soil-washing technologies at Superfund sites in the United States is assessed. Contaminants are classified as volatile, hydrophilic, or hydrophobic organics; PCBs; heavy metals; or radioactive material. Soils are classified as either sand, silt, clay, or waste fill. Three generic types of extractive treatments are identified for cleaning excavated soils: water washing augmented with a basic or surfactant agent to remove organics, and water washing with an acidic or chelating agent to remove organics and heavy metals; organics-solvent washing to remove hydrophobic organics and PCBs; and air or steam stripping to remove volatile organics.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

1322 (AD-A–209675/8/XAB) **Environmental measurements in the Beaufort Sea, Spring 1988. Technical report.** Wen, T.; Felton, W.J.; Luby, J.C.; Fox, W.L.; Kientz, K.L. Washington Univ., Seattle, WA (USA). Applied Physics Lab. Mar 1989. 117p. (APL-UW-TR–8822). Available from NTIS, PC A06/MF A01.

This report presents environmental data taken in the spring of 1988: Ice camp APLIS was established and maintained by personnel from the Applied Physics Lab. Univ. of Washington, to support Navy-sponsored research and test activities conducted in ICEX 1-88. The environmental data - weather, floe drift, CTD profiles, ice properties, and underwater noise - were gathered primarily to support the analysis of acoustic data obtained by ICEX 1-88 participants. The camp was established on a multiyear floe approximately 350 km north of Prudhoe Bay. The floe was occupied for seven weeks and evacuated on 25 April upon successful completion of test and research objectives. During the period, the floe drifted westward 155 km, driven mainly by the wind. A small amount of rotation accompanied the drift. The camp was established at the edge of a refrozen lead. Multiyear pressure ridges and rubble fields surrounded the lead and the camp. Weather information on air temperature and pressure and on wind direction and speed was recorded several times daily. Many of the research activities at the ice camp involved underwater acoustic propagation. Underwater ambient noise affected the quality of the acoustic data gathered. Sources of the noise included thermal cracking of the ice, ridging, wind-generated waves at open leads, and biological organisms.

1323 (DOE/SR/18049–1) **Composition of phytoplankton communities and their contribution to secondary productivity in Carolina Bays on the Savannah River Plant: Year one report.** Williams, J.B. South Carolina State Coll., Orangeburg, SC (USA). Dept. of Natural Sciences. Aug 1989. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract FG09-88SR18049. Order Number DE90002164. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall goal of this three-year project is to determine the importance of phytoplankton (microscopic algae) as a component of the food chain base in SRS Carolina Bays (shallow temporary ponds endemic to the Southeastern US). Previous investigations and ongoing SREL studies have determined the importance of Carolina bay zooplankton (microscopic crustacean herbivores) to the early life stages of amphibians. Our project is testing the hypothesis that phytoplankton are the primary component of zooplankton diets in these bays. Carolina Bays represent critical habitats for a whole class of vertebrates at SRS, the amphibians. Details of phytoplankton dynamics and productivity gained from our project will advance our understanding of ecological energetics within Carolina Bay systems. These results will also help determine the potential impact that these minute, but productive plants can have on SRS biota beyond the bounds of these aquatic ecosystems. Additional implications can be made concerning chemical elemental uptake and transfer from phytoplankton to higher trophic levels. 12 figs.

1324 (PB–89-178248/XAB) **Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report.** Florida State Univ., St. Petersburg, FL (USA). Inst. of Oceanography. Mar 1975. 301p. Available from NTIS, PC A14/MF A01.

See also PB–85-224053.

The Gulf of Mexico is a semi-enclosed basin with a surface area of 1,540,000 sq.km. On the north and east sides, the continental shelf makes up 22% (340,000 sq km) of this area and is covered by water shallower than 100 fathoms (180 meters). The continental slope, between 100 and 1,700 fathoms (180-3,600 meters), covers 20% (310,000 sq km) of the total area. Another 20 percent, below the depth of 1,700 fathoms, covers the Sigsbee and Florida plains. To the southeast are the two connections with other seas-the Straits of Florida with a sill depth of 475 fathoms (860 meters) and the Yucatan Channel with a 1,120-fathom (2,000-meter) sill depth. This survey provides quantitative and statistically valid baseline (benchmark) measurements of selected factors that may vary as a direct

result of oil and gas exploitation at priority locations within the MAFLA area.

5202 Chemicals Monitoring and Transport

Refer also to citation(s) 68, 203, 732, 735, 938, 1236, 1298, 1305, 1443, 1446

1325 (AD-A–205136/5/XAB) **New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987.** Teeter, A.M. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab. Dec 1988. 124p. (WES/TR/EL–88-15-2). Available from NTIS, PC A06/MF A01.

See also Rept. 1, AD-A200 178.

This report documents the evaluation of hydraulic conditions and sediment migration associated with the dredging and dredged material disposal alternatives proposed for the upper Acushnet River Estuary upstream of New Bedford Harbor, Massachusetts. Dredging and onsite disposal is one remedial measure being considered by the US Environmental Protection Agency. Assessments of sediment and contaminant migration beyond the upper New Bedford Harbor from proposed dredging and disposal alternatives were made based on field, laboratory, and various model studies. The upper estuary was found to be depositional and a reasonably efficient sediment trap. Total suspended material (TSM) concentrations were very low in the system.

1326 (AD-A–205209/0/XAB) **Review and evaluation of contingency plans for oil and hazardous substances in the upper Great Lakes region. Final report.** Gundlach, E.R.; Murday, M.; Fanning, W.L. Coastal Science and Engineering, Inc., Columbia, SC (USA). 15 Nov 1986. 273p. Available from NTIS, PC A12/MF A01.

The purpose of this study was to update and supplement a contingency plan review conducted for the Corps in 1979 by the St. Lawrence-Eastern Ontario Commission for handling oil and hazardous-substance spills on the upper Great Lakes and their connecting channels. Special attention was given to cleanup and control methods described for ice conditions that may exist in the region in winter. The report identifies existing contingency plans in the study area; tabulates amounts, types, and locations of equipment and manpower that exist to implement the plans; describes methods to contain and recover oil in ice conditions; describes spill-mitigation plans and techniques to protect natural resources; describes techniques of deflecting oil in swift flowing waters; and describes disposal plans identified in the contingency plans.

1327 (CONF-8909170–2) **A model for the future: Innovative combination of technologies for soil and groudwater VOC [volatile organic compound] remediation.** Reeme, T.L.; Hartnett, S.L.; Miller, S.F. Argonne National Lab., IL (USA). 6 Jul 1989. 13p. Sponsored by U.S. Department of Agriculture. DOE Contract W-31109-ENG-38. From 12. annual Madison waste conference; Madison, WI (USA); 20-21 Sep 1989. Order Number DE90001767. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Elevated levels of carbon tetrachloride and chloroform were detected in 1982 in a public water supply serving a small agricultural community in the Midwest. The US Environmental Protection Agency subsequently initiated an "expedited response action" and identified the contaminant source as a former grain storage facility where carbon tetrachloride had been used as a fumigant from 1955 to 1965. An innovative remedial system, operating at the facility site since early 1988, simultaneously removes volatile organic compounds from extracted groundwater by air stripping and reduces subsoil source contamination by in situ vapor extraction. This paper presents a case history of the contamination and the remedial action and discusses plans to expedite cleanup operations and increase their cost-effectiveness. 2 figs., 2 tabs.

1328 (DOE/EH–0103-Vol.1) **A compendium of options for government policy to encourage private sector responses to potential climate changes: Volume 1, Methodological justification and generic policy instruments.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Analysis. Oct 1989. 190p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90000995. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Report to the Congress of the United States.

The possibility of anthropogenic climate change is rapidly becoming an issue of significant public concern. Recent scientific research results combined with a very warm decade have led to growing apprehension that we may be on the brink of global warming inadvertently induced by human activity. As one manifestation of increasing concern, several Congressional Committee hearings on issues deriving from potential climate change have been held. Additionally, in 1986 Congress requested two studies by the Environmental Protection Agency (EPA) on the effects of climate change and on policy options to stabilize the atmosphere. Those reports currently are being reviewed by Federal agencies prior to submission to Congress. In the report language accompanying the Energy and Water Appropriations Act, 1989, the Senate Committee on Appropriations and the Conference Committee also requested four studies on climate change from the Department of Energy (DOE). The four reports are Alternative Energy R&D – to assess the state and direction of Federal R&D on alternative energy sources, including conservation; Greenhouse Gas Data Collection – to assess how greenhouse gas emission and climate trends data are coordinated, archived, and made available to scientists, both within and outside of government, Carbon Dioxide Inventory and Policy – to analyze policies to achieve a 20% reduction in CO_2 emissions in 5-10 years and a 50% reduction in 15-20 years as well as provide an inventory of emission sources; and Study of Options to Mobilize the Private Sector – to assess policy options for encouraging the private sector to cooperate in mitigating, adapting, and preventing global climate change. 286 refs., 6 figs., 7 tabs.

1329 (DOE/EH–0103-Vol.2) **A compendium of options for government policy to encourage private sector responses to potential climate change: Volume 2, Policy options by sector and considerations for assembling a policy package.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Analysis. Oct 1989. 302p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90000996. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

Report to the Congress of the United States.

Volume 1 of this report evaluated generic policy instruments according to the criteria of efficiency information requirements, distributional effects, political sustainability, and applicability to greenhouse gas issues. This volume describes policies specific to the various components of the private sector and evaluates options for the implementation of policies according to a further set of screening criteria more suitable for specific instances or applications of the instruments. The description of the private sector in this volume is confined to qualitative analysis of the constraints and opportunities arising from existing materials, processes, markets, and regulatory frameworks that are likely to shape its response to the prospect of global warming. Materials include fuels as well as other substantive material and energy inputs and outputs for the sector. For example, steel production involves iron ore, coal, perhaps electricity, and the finished product. Processes are the activities by which a sector satisfies demands for its goods and services. For example, fossil fuel combustion is a major process in the utilities sector, while fertilizer production and application are both important processes for agriculture. Markets in this context include both capital markets which finance the activities of the private sector and the markets in which commodities and services are traded and consumed. The regulatory framework quite simply is the nexus of legal constraints on entry to an activity and the rules by which the government, or alternative regulatory agency, for example, a public utility commission, controls the activities of a sector. 387 refs., 15 figs., 18 tabs.

1330 (PB–89-203616/XAB) **Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis.** Brownawell, B.J. Woods Hole Oceanographic Institution, MA (USA). Jun 1986. 322p. (WHOI–86-19). Available from NTIS, PC A14/MF A01.

Polychlorinated biphenyls (PCBs) were used to study the sorption of hydrophobic organic compounds (HOC) with colloidal organic matter in a coastal environment. A static headspace partitioning method measured the sorption of individual chlorobiphenyls with colloidal organic matter by directly determining the dissolved-phase fugacity of PCBs. Experimental results suggest that HOC-organic colloid sorption is similar to that with sediments. PCBs were measured in the interstitial waters and sediments of three box cores obtained from New Bedford Harbor and Buzzards Bay, MA. PCB concentrations were highly elevated in interstitial waters. A sediment-transport model predicted that organic colloids could be important in the flux of highly sorbed PCBs across the sediment-water interface, but that diffusive migration of PCBs in coastal sediments should be small.

1331 (PB–89-214472/XAB) **Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report.** Koussis, A.D.; Syriopoulou, D.; Ramanujam, G. Vanderbilt Univ., Nashville, TN (USA). Dept. of Civil and Environmental Engineering. Jan 1989. 137p. Available from NTIS, PC A07/MF A01.

The report delivers an accurate and efficient computational tool for three-dimensional ground-water solute transport with grid sizes and resolution required for field applications that will enable geohydrologists to carry out routinely a credible analysis and prediction of ground-water contamination. Efficient methodologies have been devised that acknowledge the nature of advection-dominated transport, and address the problem of transverse numerical diffusion caused by grid anisotropy. A suite of models has been constructed suitable for simulating transport in a steady flow field.

1332 (PB–89-214894/XAB) **Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation.** Prince, K.R.; Schneider, B.J. Geological Survey, Reston, VA (USA). Water Resources Div. 1989. 52p. (USGS/WRI–87-4211). Available from NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

This study obtained estimates of the hydraulic properties of the upper glacial and Magothy aquifers in the East Meadow area for use in analyzing the movement of reclaimed waste water through the aquifer system. This report presents drawdown and recovery data form the two aquifer tests of 1978 and 1985, describes the six methods of analysis used, and summarizes the results of the analyses in tables and graphs. The drawdown and recovery data were analyzed through three simple analytical equations, two curve-matching techniques, and a finite-element radial-flow model. The resulting estimates of hydraulic conductivity, anisotropy, and storage characteristics were used as initial input values to the finite-element radial-flow model (Reilly, 1984). The flow model was then used to refine the estimates of the aquifer properties by more accurately representing the aquifer geometry and field conditions of the pumping tests.

1333 (PB–89-217145/XAB) **Advanced precoat filtration and competitive processes for water purification. Technical report.** Wang, L.K.; Wang, M.H.S. Lenox Inst. for Research, Inc., MA (USA). 28 Jan 1989. 26p. (LIR–01-89/337). Available from NTIS, PC A03/MF A01.

An advanced precoat filtration process system is introduced. Also presented and discussed are major competitive processes for water purification, such as conventional precoat filtration, conventional physical-chemical process, lime softening, carbon adsorption, ion exchange, activated alumina, reverse osmosis, ultrafiltration, microfiltration, electrodialysis, and packed aeration column.

1334 (PB–89-217566/XAB) **Contribution of subsoil and aquifer microorganisms to ground-water quality. Technical report, 1 July 1988-30 June 1989. (Final).** Turco, R.F.; Konopka, A.E. Purdue Univ., Lafayette, IN (USA). Water Resources Research Center. Jun 1989. 36p. (TR–177). Available from NTIS, PC A03/MF A01.

Little information about the microbiology of the subsurface environment is available. The study was conducted to better understand the microbiology and microbial processes that occur in the subsurface under a typical midwestern agricultural soil. A 26-meter bore was installed in November of 1988. Sterile collections of soils were made at 17 different depths. A physical as well as biological investigation of the subsurface materials was conducted. Among the measured parameters were particle-size analysis, carbon, carbonates, nitrogen, phosphorus, potassium, and water-holding capacity. The level of three pesticides, atrazine, metolachlor, and alachlor, was determined. Microbial biomass was assessed using direct counts, phospholipid content, and plate counts. The ability of microbial populations resident in the strata to use glucose, phenol, aniline, (14)C-ring labeled 2-methyl-6-ethyl-aniline, (14)C-ring labeled metolachlor, (14)C-carbonyl labeled metolachlor, and atrazine was assessed. Physical analysis indicated that the site contained up to 17 different strata. The site materials were primarily glacial tills with high carbonate content. Microbial numbers and activity in the tills was much lower than either in the surface materials or the aquifer located at 25 m.

1335 (PB–89-217913/XAB) **Briefing report to the EPA (Environmental Protection Agency) Science Advisory Board: The apparent effects threshold approach. Briefing report (Final).** Barrick, R.; Beller, H. Battelle Columbus Div., OH (USA). Sep 1988. 63p. Available from NTIS, PC A04/MF A01.

The Apparent Effects Threshold (AET) Approach has been used to develop sediment-quality values for 58 chemicals in Puget Sound. AET values are currently being used to make contaminated sediment management decisions in a variety of regulatory programs. The State of Washington is considering using the AET approach as a basis for setting state sediment-quality standards. The report was prepared for Region 10 for submission to EPA's Science Advisory Board. The region requested that the Board conduct a critical scientific review of the AET method. The briefing report contains a description of the method and guidelines for AET generation. Additionally, the report details AET field-validation studies and presents conclusions regarding the reliability of the approach in predicting adverse biological impacts in the field. Finally, the report describes uncertainties associated with AET generation and application in regulatory programs.

1336 (PB–89-220016/XAB) **Workshop summary report: Water-quality criteria to protect wildlife resources. Report on pollutants considered to pose the greatest threat to wildlife when existing water-quality criteria are met.** Kilkelly Environmental Associates, Inc., Raleigh, NC (USA). Aug 1989. 65p. Available from NTIS, PC A04/MF A01.

The workshop was convened to identify and define the need for water-quality criteria to protect wildlife species. The workshop's goals were to (1) generate a strategy for developing wildlife criteria based on available toxicological data, (2) recommend an approach to incorporating wildlife criteria into the regulatory process, and (3) identify research needs. Although workshop participants believe that existing aquatic-life water-quality criteria will in general protect wildlife species, they identified several important exceptions. The recommended procedures are designed to develop a method for identifying chemicals likely to adversely affect wildlife and to provide a mechanism for developing protective criteria.

1337 (PB–89-220461/XAB) **Methods for the determination of organic compounds in drinking water.** Environmental Protection Agency, Cincinnati, OH (USA). Environmental Monitoring Systems Lab. Dec 1988. 392p. (EPA–600/4-88/039). Available from NTIS, PC A17/MF A01.

Thirteen analytical methods for the identification and measurement of organic compounds in drinking water are described in detail. Six of the methods are for volatile organic compounds (VOCs) and certain disinfection by-products. These methods were cited in the Federal Register of July 8, 1987, under the National Primary Drinking Water Regulations. The other seven methods are designed for the determination of a variety of synthetic organic compounds and pesticides, and these methods were cited in proposed drinking-water regulations in the Federal Register of May 22, 1989. Five of the methods utilize the inert gas purge-and-trap extraction procedure for VOCs, six methods employ a classical liquid-liquid extraction, one method uses a new liquid-solid extraction technique, and one method is for direct aqueous analysis. Of the 13 methods, 12 use either packed or capillary gas-chromatography column separations followed by detection with mass spectrometry or a selective

gas-chromatography detector. One method is based on a high-performance liquid-chromatography separation.

1338 (PB–89-869150/XAB) **Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 76p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867171.

This bibliography contains citations of selected patents concerning activated charcoal filters and their applications in water treatment, pollution control, and industrial processes. Filtering methods and equipment for air and water purification, industrial distillation and extraction, industrial leaching, and filtration of toxic materials and contaminants are described. Applications include drinking-water purification, filtering beverages, production of polymer materials, solvent and metal recovery, waste conversion, automotive fuel and exhaust systems, swimming-pool filtration, tobacco-smoke filters, kitchen ventilators, medical-filtration treatment, and odor absorbing materials. (This updated bibliography contains 161 citations, 32 of which are new entries to the previous edition.)

1339 (PB–89-869804/XAB) **Microbiology of ground water. January 1977-August 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 157p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868377.

This bibliography contains citations concerning the enumeration, characterization, movement, and monitoring of microorganisms in potable and non potable ground water from a wide variety of natural and anthropogenic sources. Considerable attention is given to the effects, treatment, and removal of various microorganisms contained in ground water. (This updated bibliography contains 259 citations, 57 of which are new entries to the previous edition.)

1340 (PB–89-870158/XAB) **Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 126p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867874.

This bibliography contains citations concerning the utilization of ozone for the purification of industrial waste water, sewage, and drinking water. Topics include laboratory and field investigations of ozone-purification techniques alone, and in combination with other treatment methods. Some attention is given to toxic effects of products resulting from ozone treatment of sewage and waste waters. (This updated bibliography contains 219 citations, 11 of which are new entries to the previous edition.)

1341 (PNL-SA–16897) **Identification of contaminants of concern in Hanford ground waters.** Sherwood, D.R.; Evans, J.C.; Bryce, R.N. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–6: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90001897. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

More than 1500 waste disposal sites have been identified at the US Department of Energy (DOE) Hanford Site. At the request of the US Environmental Protection Agency, these waste-disposal sites were aggregated into four administrative areas in preparation for listing the Hanford Site on the National Priority List. Six hundred forty-six inactive waste sites within the four aggregate areas were selected for further evaluation using the Hazard Ranking System (HRS) (EPA 1984) methodology. During this period, ground-water monitoring efforts on the Hanford Site were expanded to address the presence and extent of chemical hazardous substances and additional radionuclides. Development of a monitoring network for this purpose for all areas of the Hanford Site requires a thorough review of past disposal practices. Data gathered to evaluate inactive waste sites by the HRS scoring process provided valuable information that was used to design a focused radiological and hazardous substance monitoring network. One aspect of the HRS scoring process considers the likelihood of ground-water contamination resulting from disposal practices at inactive waste sites. A monitoring network developed to investigate contaminants of concern at those facilities identified iodine-129, technetium-99, strontium-90, uranium, chromium, carbon tetrachloride, and cyanide as contaminants of concern in Hanford ground waters. 7 refs., 4 figs.

1342 **Trace substances present as chlorination by-products in drinking and process waters.** Jolley, R.L. (Oak Ridge National Lab., TN (USA)). *Trace Substances in Environmental Health (USA)*, 12: 205-214 (1988). (CONF-8805159–: 22. annual conference on trace substances in environmental health, St. Louis, MO (USA), 23-26 May 1988).

Chlorination is a process commonly used for disinfection of potable water supplies, for the treatment of a variety of process waters such as wastewater and cooling waters, and for many industrial processes such as paper pulp bleaching. Such use is based on the reactive and oxidative properties of aqueous chlorine species in which the chlorine is present at a valence state of plus one (i.e., Cl^+ in HOCl or Cl_2). Both HOCl and Cl_2 are powerful oxidants and appear to be the principal agents responsible for the chlorine substitution reactions. During the last 15 years, increasing attention has been focused on the formation of chloro-organic by-products during the chlorination process, especially in drinking water because of public health concern regarding the toxicological properties of halogenated organics. This paper briefly reviews the chemistry of chlorine germane to the formation of chloro-organics and summarizes some of the more recent developments.

1343 **Underwater measuring gage.** Lockhart, J.L. To Dept. of Energy, Washington, DC. USA Patent 4,837,936. 13 Jun 1989. Filed date 30 Nov 1987. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a device for remotely measuring the diameter of wire rope. The device includes a linear variable differential transducer, a mechanism to guide and clamp the rope in relation to the anvil of the transducer, an elongated handle for manually manipulating the transducer and the guide and clamp mechanism.

5203 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 180, 181, 201, 527, 535, 1284, 1285

1344 (BfG–0447) **Comparative analysis of tritium in water, 1987.** Krause, W.J.; Mundschenk, H. Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.); Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.). Jul 1988. 92p. (In German). Order Number DE90717904. Available from NTIS (US Sales Only), PC A05/MF A01.

The determination of tritium content within the examined concentration range of 4 ... 90 Bq/l is satisfactorily mastered by most of the participants. As far as accuracy, and not so much correctness, is concerned, it is indeed essential whether the determination takes place without electrolytic enrichment (direct L.S.C. measurement), or after electrolytic enrichment, or as a counter gas measurement. For the determination to be reliable, it is important to prepare proper zero, calibration and measuring samples, to adequately adjust and calibrate measuring arrangements, and to make an appropriate choice of measuring parameters, taking environmental conditions (background) into consideration. Possible error causes are mentioned with respect to individual deviations and enlarged scattering ranges. (orig./HP).

1345 (CONF-891013–4) **Application of supported liquid membranes for removal of uranium from groundwater.** Chiarizia, R.; Horwitz, E.P.; Rickert, P.G.; Hodgson, K.M. Argonne National Lab., IL (USA). [1989]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989. Order Number DE90001941. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The separation of uranium from Hanford site groundwater as studied by hollow-fiber supported liquid membranes, SLM. The carrier bis(2,4,4-trimethylpentyl)phosphinic acid, H[DTMPep], contained in the commercial extractant Cyanex™ 272 was used as a membrane carrier, because of its selectivity for U over calcium and magnesium. The water soluble complexing agent, 1-hydroxyethane-1,1-diphosphonic acid, HEDPA, was used as stripping agent. Polypropylene hollow-fibers and n-dodecane were used as polymeric support and diluent, respectively. Laboratory scale hollow-fiber modules were employed in a recycling mode, using as feed synthetic groundwater at pH 2, to confirm the capability of the proposed SLM system to separate and concentrate U(VI) in the strip solution. Information was obtained on the U(VI) concentration factor and on the long-term performance of the SLMs. Encouraging results were obtained both with a conventional module and with a module containing a carrier solution reservoir. Industrial scale modules were used at Hanford to test the SLM separation of U(VI) from real contaminated groundwater. The uranium concentration was reduced from approximately 3500 ppB to about 1 ppB in a few hours. 9 refs., 8 figs., 4 tabs.

1346 (PB–89-202402/XAB) **Evaluating various adsorbents and membranes for removing radium from ground water.** Clifford, D.; Vijjeswarapu, W.; Subramonian, S. Houston Univ., TX (USA). Dept. of Civil and Environmental Engineering. 1988. 14p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of American Water Works Association, Vol. 80, 94-104(Jul 1988).

Field studies were conducted in Lemont, IL to evaluate specific adsorbents and reverse osmosis (RO) membranes for removing radium from ground water. A radium-selective complexer and barium-sulfate-loaded alumina appeared to have the best potential for low-cost adsorption of radium from raw water or ion-exchange brines, provided that the problem of the ultimate disposal of spent media can be solved. A new, low-pressure (70-psig) RO module achieved radium and total dissolved solids (TDS) rejections of 91 and 87%, respectively. Central treatment with standard or low-pressure RO modules would be effective for radium removal but would be expensive and unnecessary if TDS reduction is not also required. Point-of-use treatment using RO is effective for removing radium and may be cost-effective for very small communities.

1347 (PB–89-218259/XAB) **Removal of uranium from drinking water by conventional treatment methods.** Sorg, T.J. Environmental Protection Agency, Cincinnati, OH (USA). Drinking Water Research Div. Jan 1989. 28p. (EPA–600/D-89/020). Available from NTIS, PC A03/MF A01.

The USEPA currently does not regulate uranium in drinking water but will be revising the radionuclide regulations during 1989 and will propose a maximum contaminant level for uranium. This paper presents treatment technology information on the effectiveness of conventional methods to removal uranium from drinking water. Treatment information based primarily on laboratory and pilot plant studies is presented on conventional coagulation/filtration, ion exchange, lime softening, and reverse osmosis. Ion-exchange treatment has been applied successfully on ground waters by small systems.

1348 (PB–89-862247/XAB) **Radioactive contamination and radionuclide migration in ground water. January 1970-May 1989 (Citations from the NTIS data base). Report for January 1970-May 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 125p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the contamination of groundwater with radionuclides and their subsequent migration. Monitoring surveys of existing sites with actual or potential radioactive groundwater contamination are included. Transport and migration models for radionuclides in groundwater are discussed. Natural radiation and accidental releases are considered in addition to anthropogenic sources of radioactive pollution such as waste storage and disposal. Contributions to radioactive pollution from uranium mining and processing is discussed in a separate bibliography. (Contains 209 citations fully indexed and including a title list.)

1349 **Contained radiological analytical chemistry module.** Barney, D.M. To Dept. of Energy, Washington, DC. USA Patent 4,838,098. 13 Jun 1989. Filed date 2 Dec 1987. Int. Cl. G01N 7/00. 8p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a system which provides analytical determination of water chemistry parameters with respect to water samples subject to radiological contamination. The system includes a water sample analyzer disposed with a containment and comprising a sampling section for providing predetermined volumes of samples for analysis; a flow control section for controlling the flow through the system; and a gas analysis section for analyzing samples provided by the sampling system. The sampling section includes a controllable multiple port valve for in one position, metering out sample of a predetermined volume and for, in a second position, delivering the material sample for analysis. The flow control section includes a regulator valve for reducing the pressure in a portion of the system to provide a low pressure region, and measurement devices located in the low pressure region for measuring sample parameters such as pH and conductivity, at low pressure. The gas analysis section which is of independent utility provides for isolating a small water sample and extracting the dissolved gases therefrom into a small expansion volume wherein the gas pressure and thermoconductivity of the extracted gas are measured.

5205 Site Resource and Use Studies

1350 (CRIE-U–88020) **Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water.** Mahara, Yasunori; Osumi, Takashi; Nakagawa, Kamiichiro; Igarashi, Toshifumi. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Oct 1988. 24p. (In Japanese). Order Number DE89901255. Available from NTIS (US Sales Only), PC A03/MF A01.

To develop protection technology of groundwater environment required for the water resources development and for the large-scale underground space utilization, it is necessary to survey groundwater hydrology and to find out the residence time and the flow circumstances of the groundwater. Therefore,a dating method of groundwater by measuring the dissolved gas is being investigated. Prior to the establishment of a dissolved rare gas measuring method. a technology to get groundwater sample was investigated and following results were obtained. A small-sized(outer diameter 38mm),pressurized, and sealed type groundwater sampler was designed and fabricated. It makes groundwater sampling possible to the maximum depth of 400m. A performance test of the groundwater sampler was conducted using in-situ borings,and its groundwater sampling performance was confirmed.The material for the groundwater sampling tube to confirm the life of the sample sealed for a long time was selected.Steel clamps for sealing were designed and fabricated, and their performance was confirmed. 11 refs., 9 figs., 2 tabs.

5206 Regulations

Refer also to citation(s) 73, 1291, 1299, 1300

1351 (PB–89-142533/XAB) **Best demonstrated available technology (BDAT) background document for K099 (non CBI version). Final report.** Berlow, J.R.; Vorbach, J. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. Aug 1988. 110p. (EPA–530/SW-88/031S). Available from NTIS, PC A06/MF A01.

See also PB–89-142350.

This background document provides the Agency's rationale and technical support for selecting the constituents to be regulated in K099 waste and for developing treatment standards for those regulated constituents. The document also provides waste-characterization information that serves as a basis for determining whether treatment variances may be warranted.

1352 (PB–89-175442/XAB) **EPA (Environmental Protection Agency) workshop to recommend a minimum set of data elements for ground water: workshop findings report.** American Management Systems, Inc., Arlington, VA (USA). Jun 1988. 33p. Available from NTIS, PC A03/MF A01.

A Work Group of States, the EPA, and other Federal Agencies reached consensus on a minimum set of data elements for ground water. The minimum set of data elements for ground water is defined as those elements necessary to use data from wells and springs across ground-water regulated programs. It is the common set of elements which forms the basis for making ground-water decisions. The set is characterized by elements that are needed to communicate ground-water data across programs: common to all programs, completely adequate for some programs, provides a road map to other data, and provides a link between water quality and well-location information. Implementation issues are identified.

1353 (PB–89-205967/XAB) **Ecological assessment of hazardous-waste sites: A field and laboratory reference.** Warren-Hicks, W.; Parkhurst, B.R.; Baker, S.S. Kilkelly Environmental Associates, Inc., Raleigh, NC (USA). Mar 1989. 301p. Available from NTIS, PC A14/MF A01.

Also available from Supt. of Docs.

This document discusses the scientific basis for assessing adverse ecological effects at hazardous-waste sites (HWSs), and presents methods for evaluating the on-site and off-site ecological effects of HWSs. The methods are intended for implementation in the early phases of the HWS evaluation process and should be used as integral parts of HWS evaluations. The document is intended for use by administrative and scientific personnel with a strong background in the environmental sciences, including laboratory and field procedures, and environmental assessment strategies.

1354 (PB–89-206023/XAB) **Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993.** Environmental Protection Agency, Chicago, IL (USA). Great Lakes National Program Office. Dec 1988. 94p. (EPA–905/9-89/001). Available from NTIS, PC A05/MF A01.

Also available from Supt. of Docs. See also PB–86-107984.

Contents include: the Great Lakes National Program Office; the Great Lakes ecosystem; current Great Lakes water-quality problems; regulatory and remedial programs; the Clean Water Act; the Great Lakes Water-Quality Agreement; a five-year program strategy; environmental management plans; remedial activities; research; technology development and transfer; international/interagency/intra-agency coordination; and public education and involvement.

1355 (PB–89-211726/XAB) **Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final).** Hetes, R.G. North Carolina Univ., Chapel Hill, NC (USA). Dept. of Environmental Sciences and Engineering. 1988. 96p. Available from NTIS, PC A05/MF A01.

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), more commonly called Superfund, established a national program for responding to releases of hazardous substances into the environment. Central to the Superfund program are the questions of which sites are deserving of remedial action and to what extent they should be cleaned. This report includes a summary and analysis of the existing method of remedial-action selection, both in design and practice. The consensus is that the existing process as designed is adequate, but problems arise from inconsistent application. The conventional risk assessment is found to be limited in addressing multi-compound and multi-media situations. The report identifies four alternatives to the conventional risk assessment. Conclusions include: concentration-based standards yielding consistent outcomes inadequately address additivity, exposure, costs, and site characteristics; best demonstrated available technology holds the greatest future promise for acceptability and effectiveness but is presently inadequate due to limited existing experience; benefit-cost analysis is not viable because CERCLA issues are not conducive to economic quantification; improved risk assessment has the greatest short-term potential for augmenting existing methods, not requiring extensive change, and better addressing multiple contaminant and media situations.

1356 (PB–89-211734/XAB) **Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis.** Landers, J.C. Cornell Univ., Ithaca, NY (USA). Center for Environmental Research. May 1989. 248p. Available from NTIS, PC A11/MF A01.

The EPA's Region V Clean Lakes Program uses several wetlands for controlling degradation of publicly owned, freshwater lakes. The study seeks to determine if the objectives of the Clean Lakes Program are being met by this use of wetlands, and if appropriate institutional arrangements and management techniques are being implemented to manage the wetlands. Conclusions regarding Revion V's use and management of wetlands include: wetland projects are not being monitored adequately for effectiveness and potential negative impacts on ecosystems; other mechanisms which may help to protect wetlands are being employed; management of most wetland projects is decentralized appropriately; most of the wetland projects provide for adequate short-term mass balance studies, prior sedimentation, plant species diversity, water level, retention time, uniform flow of water, and upland pollutant management; and existing evidence suggests that the Clean Lakes wetland projects are instrumental in meeting Program goals and objectives. Based on these conclusions several recommendations for improving wetlands management are reviewed.

1357 (PB–89-218184/XAB) **Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act.** Crumpler, E.P.; Fradkin, L. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. 1989. 9p. (EPA–600/D-89/018). Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of the National Conference on Municipal Sewage Treatment Plant Sludge Management, Series No. 17, Hazardous Materials Control Research Institute, Silver Spring, MD, 30-35(1987). See also PB–89-218176.

The need for effective sludge management is continual and growing. In the United States, the quantity of municipal sludge produced annually has almost doubled since 1972. The U.S. EPA established an Agency Sludge Task Force in 1982. In 1983 one of the Task Force's major recommendations was to develop a comprehensive technical regulatory program under Section 405(d) of the Clean Water Act that requires the U.S. EPA to develop and issue regulations which (1) identify uses for sludge including disposal; (2) specify factors to be taken into account in determining the measures and practices applicable for each use or disposal (including costs); and (3) identify concentrations of pollutant which interfere with each use or disposal. The major areas discussed in this manuscript are; regulation development, incineration, selection of model plants, air-dispersion modeling, most exposed individual, risk level, reference air concentration, and an example calculation.

1358 (PB–89-225502/XAB) **Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 7 Sep 1988. 60p. (EPA/ROD/R–05-88/073). Available from NTIS, PC A04/MF A01.

Portions of this document are not fully legible.

The six-acre U.S. Aviex site is located in the City of Niles, Howard Township, Cass County, Michigan. Surface runoff from the site and surrounding areas flows toward Bome-Huntly Drain, a tributary of St. Joseph River, and ultimately Lake Michigan. U.S. Aviex produced non-lubricating automotive fluids from the early 1960s until 1978. During operations at the plant, chlorinated hydrocarbons, including trichloroethane (TCA), were released into the vadose zone south of the process room. The subsurface soil still contains significant quantities of TCA, TCE, and PCE. The selected remedial action for this site includes: soil flushing of approximately 11,500 cu yd of contaminated onsite soil; and collection of onsite and offsite ground water and fluids from the soil-flushing process with treatment onsite by air stripping, and discharge to surface water.

1359 (PB–89-225551/XAB) **Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 29 Sep 1988. 35p. (EPA/ROD/R–09-88/020). Available from NTIS, PC A03/MF A01.

See also PB–88-220926.

The San Gabriel Valley site consist of four large areas of groundwater contamination located approximately 10-20 miles east of Los

Angeles in Los Angeles County, California. The sites include industrial, commercial, residential, and undeveloped areas. The contaminated ground water underlies significant portions of several cities and outlying areas of the San Gabriel Valley, and appears to be the result of inadequate handling and disposal of industrial solvents by dozens of industrial/commercial facilities. This ROD addresses contamination in the Bartolo Well Field, a private water utility, owned and operated by Suburban Water Systems (SWS) and located along the east side of the San Gabriel River in the Whittier Narrows area. The selected remedial action for this site includes: onsite ground-water pump and treatment using an air-stripping system equipped with air emissions controls, with subsuquent discharge to the utility's water distribution system; floodproofing the treatment facility; and ground-water monitoring.

1360 (PB–89-225569/XAB) **Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Sep 1988. 46p. (EPA/ROD/R–09-88/022). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

The Ordot Landfill site is located on the Island of Guam. The landfill is in a volcanic upland region, where site runoff flows directly into the adjacent Lonfit River. There is concern, however, that a suspected fault near the landfill may provide a hydrologic connection between the contaminants at Ordot Landfill and Guam's major drinking-water acquifer located in the northern limestone province of Guam. Because it is the only major public waste-disposal site on Guam it has received some hazardous waste during its history, including spent industrial and commercial chemicals, PCB-contaminated oils from transformers, and perhaps munitions. The selected remedial action for this site is the no-action alternative.

1361 **Groundwater resources on Long Island. Joint hearing before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science, Space, and Technology, US House of Representatives and the Subcommittee on Water Resources, Transportation, and Infrastructure of the Committee on Environment and Public Works, US Senate, One Hundredth Congress, First Session, November 30, 1987.** 129p. Government Printing Office, Washington, DC (US) (1988).

This is fourth in a series of hearings held by the Subcommittee on Natural Resources, Agriculture Research, and Environment in an ongoing effort to gain a better understanding of the impact of ground water contamination in our nation. The area of main concern in this session is the impact of ground water contamination both on the quality of water and the quantity of water in Nashua and Suffolk County, New York.

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

1362 (DOE/SR/15199–2) **Savannah River Archaeological Research Program annual report, Fiscal years 1988–1989.** South Carolina Univ., Columbia, SC (USA). Savannah River Archaeological Research Program. Sep 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract FC09-88SR15199. Order Number DE90001935. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The beginning of a new era for the Savannah River Archaeological Research Program (SRARP), South Carolina Institute of Archaeology and Anthropology (SCIAA), University of South Carolina (USC) came in 1987 with the initiation of a cooperative agreement for archaeological resource management, research and public education. After 15 years and six different contracts the Savannah River Archaeological Research Program, under the leadership of Glen T. Hanson, negotiated a cooperative grant with the Savannah River Operations Office, United States Department of Energy (DOE) to conduct archaeological research in the Savannah River Valley focusing on the Savannah River Site (SRS). Archaeological resource management advisement to DOE involves recommendations regarding the evaluation, conservation and preservation of archaeological resources. SRARP maintains a comprehensive database of archaeological information for over 850 currently known sites located thus far on the 300 square mile SRS. All records, artifact collections and analytical reports for these sites are maintained at the SRARP lab and are available for scholarly research. The site files have been updated and verified and are accessible through Macintosh computers with Claris' Filemaker® program. 51 refs.

5301 Social and Economic Studies

Refer also to citation(s) 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 1261

5302 Assessment of Energy Technologies

Refer also to citation(s) 1261, 1297

1363 (AD-A–209676/6/XAB) **Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll.** Army Strategic Defense Command, Huntsville, AL (USA). Jun 1989. 394p. Available from NTIS, PC A17/MF A01.

Original contains color plates: All DTIC/NTIS reproductions will be in black and white.

This report is the Draft Environmental Impact Statement(DEIS) for the proposed actions at the U.S. Army Kwajalein Atoll (USAKA). The proposed action would include continuation of current activities at USAKA and planned non-Strategic Defense Initiative (SDI) activities as well as proposed SDI activities. The U.S. Army Strategic Defense Command will conduct two public hearings as part of the environmental impact analysis process. The close of the public comment period on the DEIS is August 7, 1989. The comments received during the public hearings, as well as written comments received during the public-comment period, will be used to develop the final environmental impact statement which is scheduled to be published in October 1989.

1364 (DOE/EIS–0134-F) **Charlie Creek–Belfield Transmission Line Project, North Dakota: Final Environmental Impact Statement.** Department of Energy, Billings, MT (USA). Western Area Power Administration. 1989. 102p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002098. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Western Area Power Administration (Western) proposed to construct, operate, and maintain approximately 40.9 miles of new 345-kV transmission line between Charlie Creek and Belfield, North Dakota. The area is presently served by a single 345-kV transmission line from the Antelope Valley Station and several 115-kV transmission lines from Garrison, Tioga, Wolf Point, and Richland. This system is in need of added transmission capacity to correct low voltages, overloaded facilities, and loss of service that has been experienced and which will worsen as loads grow in the area. The proposed action would provide improved service to area loads and system reliability, contribute to energy conservation, and provide additional flexibility for future expansion when and if it becomes necessary. Alternatives considered include no action, energy conservation, other transmission systems and technologies, and the proposed action with routing and design alternatives. Unavoidable adverse effects of the proposed action would be construction related impacts on agricultural, visual, and cultural resources. 18 refs.

1365 (PB–89-214951/XAB) **Proposed Resource Management Plan Amendment/Final Environmental Impact Statement for McGregor Range.** Bureau of Land Management, Las Cruces, NM (USA). Las Cruces District Office. May 1989. 161p. (BLM/NM/PT–89/009/4410). Available from NTIS, PC A08/MF A01.

Also available from Supt. of Docs.

The White Sands Resource Management Plan Amendment (RMPA) and Environmental Impact Statement (EIS) for McGregor Range explores future management options for the 608,385 acres of withdrawn public land within McGregor Range in Otero County in south-central New Mexico. The need for the RMPA resulted from the passage of the Military Lands Withdrawal Act in 1986, which withdrew the land for military purposes. The RMPA/EIS is prepared as a single-planning issue document to address to what degree

public use of the resources will be allowed and the intensity of BLM resource management on McGregor Range. Three alternatives are considered in detail. The main change to the Preferred Alternative is the addition of the Cockleburr watershed area for the development of a watershed-management plan. In addition, the predator control proposal was revised based on comments from the New Mexico Animal Damage Control Program.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

Refer also to citation(s) 226, 233, 240, 242, 631, 1391, 1408, 1464, 2006

1366 (BNL–52215) **Biotechnology at Brookhaven National Laboratory.** Brookhaven National Lab., Upton, NY (USA). Oct 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001777. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Brookhaven National Laboratory (BNL) is a multiprogram laboratory that carries out basic and applied research in the physical, biomedical and environmental sciences and in selected energy technologies. The Laboratory is supported by the US Department of Energy and other federal agencies. Biotechnology at BNL is an interdepartmental/interdisciplinary effort, drawing on the expertise of a large group of staff scientists and their laboratory facilities. Currently, active programs which encompass applied and basic research activities address several key areas of biotechnology. These activities represent a broad base for continuity, expansion and development of biotechnology at BNL. In this document a brief description of the various capabilities is given. Scientists associated with each program are also identified.

1367 **Molecular biology of seed storage proteins and lectins.** Shannon, L.M.; Chrispeels, M.J. (eds.). 239p. American Society of Plant Physiologists, Rockville, MD (US) (Jan 1986). Sponsored by U.S. DOE Energy Research. DOE Contract FG03-85ER13334. From 9. annual symposium in plant physiology: molecular biology of seed storage proteins and lectins; Riverside, CA (USA); 9-11 Jan 1986.

The seeds of many plants contain abundant storage protein and lectin which have been the subject of biochemical investigations for over a hundred years. Because these proteins represent abundant gene products translated from abundant messages, they were among the first plant proteins to which the techniques of molecular biology were applied. Many of the proteins have now been purified and characterized and their amino acid sequences have been determined; some have been crystallized and their 3-dimensional structure is known. Studies of their biosynthesis, transport and accumulation in protein bodies have lead to a greater understanding of the dynamics of plant cell organelles. Seed storage proteins and lectins are encoded by small gene families whose members show considerable homology and appear to have been conserved in evolution. The expression of these genes is highly regulated in time (development) and space (tissue). The recent discovery that other plant organs synthesize lectins, or lectin-like proteins which are closely related to the seed lectins, has lent additional support to the search for a function for these intriguing proteins; this finding also indicates that different members of the gene family are expressed in different tissues. Individual papers were processed separately for the data base.

1368 (CONF-8905235–1) **"Integrase" protein of murine leukemia viruses.** Yang, Wen K.; Chang, Lan-Yang; Sundseth, R.; Myer, F.E.; Yang, Den-Mei. Oak Ridge National Lab., TN (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC05-84OR21400. From Symposium on biomedical sciences: function and structure of nucleic acids and proteins; Taipei (Taiwan); 13 May 1989. Order Number DE90001610. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The defined mapping of the MuLV integrase in previous work (10,11) has made it possible for us to design and construct molecular clones for expression of this protein in bacteria and thus easily obtain specific antisera. Our repeated inability to isolate the antigenic MuLV virion p46 protein without the use of a denaturing reagent, although preventing us from carrying out the contemplated enzymological studies, would imply that the integration function of MuLV is more stringently controlled at the virion structure level than is that of avian retroviruses. Thus, gene transfer and therapy procedures would be safer to the recipient by using the MuLV retroviral vector than the avian retroviral vector, since p46 is less likely than p32 to be aberrantly released to cause genomic damage to the cell. The apparent cytotoxity of transfection with mammalian expression vectors carrying the integrase gene is not unexpected in situations where a high level of this protein is expressed and accumulated in the nucleus. The apparently incidental emergence of neoplastic phenotypes in some stably transfected cells would cause genomic instability and gene rearrangement of the oncogenic components. This possibility is particularly noteworthy for endogenous retroviral gene elements, in which the control of integrase gene expression and function may not be as stringent as in the infectious MuLVs. 28 refs., 5 figs.

1369 (DOE/ER/13371–1-Vol.6, pp. 15-24) **Regulation of ethylene biosynthesis in plants; properties of ACC synthase.** Bleecker, A.B. (Michigan State Univ., East Lansing (USA)). Missouri Univ., Columbia, MO (USA). 1987. DOE Contract AC02-76ER01338. (CONF-8704340–: 6. annual plant biochemistry and physiology symposium, Columbia, MO (USA), 1-3 Apr 1987). In *Current topics in plant biochemistry and physiology: Volume 6.* Order Number DE89003080. Available from NTIS, PC A09/MF A01.

The rate of ethylene biosynthesis in plant tissues is governed primarily by the enzyme ACC-synthase. Purification of the enzyme using MAb technology indicated that the enzyme consisted of a 50 kDa polypeptide. Stress induced increase in ethylene biosynthesis in tomato fruit tissue resulted from an increase in the synthesis of the 50 kDa protein. These results are consistent with the possibility that ACC synthase activity is regulated at the transcriptional level. Future work in their laboratory will approach this question using the techniques of in vitro translation/immunoprecipitation and direct measurements of ACC-synthase specific mRNA one nucleic acid probes for the gene are isolated.

1370 (DOE/ER/60636–T3) **Amplification of oncogenes in early-stage, radiation-induced rat skin tumours.** Ashkenazi-Kimmel, T. New York Univ., NY (USA). Oct 1989. 73p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60636. Order Number DE90001452. Available from NTIS, PC A04/MF A01; OSTI; INIS.

The effect of gene amplification on tumour size and growth was investigated in 39 samples collected from 23 radiation-induced rat skin tumours. The relationships of both the time from irradiation and the time from first appearance of the tumour to gene amplification were also examined. DNA from each tumour sample was extracted and probed for abl, fos, c-myc, N-myc, H-ras, and K-ras, and amplification of all but N-myc was detected. A single amplified gene was observed in 8 of 39 samples; multiple amplified genes were found in an additional 7. The amplification of c-myc, H-ras, or K-ras was found to be associated with increase in tumour size. c-myc amplification was also associated with an increase in growth rate. Amplification of c-myc was found to occur as a late-stage event in these tumours. The results suggest that both myc and ras genes play unique roles in the growth and development of radiation tumours, and they provide new information on the temporal aspects of c-myc activation. 77 refs., 26 figs., 11 tabs.

1371 (DOE/ER/60674–2) **Base sequence effects on interactions of aromatic mutagens with DNA [deoxyribonucleic acid]: Progress report, December 1, 1988–October 15, 1989.** Geacintov, N.E. New York Univ., NY (USA). Dept. of Chemistry. 22 Oct 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60674. Order Number DE90002037. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The base-sequence dependence of the adduct conformations-derived from the covalent binding of trans-7,8-diol-anti-9,10–epoxy-7,8,9,10-tetrahydrobenzo[a]pyrene (BPDE) (+) and

(-) enantiomers to synthetic DNAs of defined base composition and sequence is described. The diol epoxide BPDE is the ultimate mutagenic and tumorigenic metabolite of benzo[a]pyrene, a common air pollutant, which is a byproduct of fossil fuel combustion processes. The covalent addition products of BPDE can be classified according to two types: (1) site I, involving carcinogen-DNA base stacking interactions, and (2) site II, in which the BPDE residue appears to be located at a partially external DNA binding site. The presence of site II adducts, rather than site I adducts, is correlated with high mutagenicities and tumorigenicities of polycyclic aromatic diol epoxides. It is shown here that the formation of site II adducts derived from the binding of the more tumorigenic (+)- BPDE enantiomer to DNA is particularly favored in deoxyguanine-rich sequences. 12 refs., 6 figs., 3 tabs.

1372 (DOE/FTR–90001702) **[Research on the structure of the adenovirus virion]: Foreign trip report, July 9–August 1, 1989.** Anderson, C.W. Brookhaven National Lab., Upton, NY (USA). 20 Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001702. Available from NTIS, PC A02/MF A01 - OSTI.

The 1989 ICRF Tumor Virus Meeting, held at Churchill College, Cambridge, England, was the 20th in this series of annual meetings on the molecular biology of tumor viruses. Approximately 300 scientists representing most countries with research programs in biological sciences attended the meeting. Major topics discussed at the meeting included the mechanism of DNA replication in human cells, factors that regulate gene expression and cell growth, and virus structure and assembly. This Investigator was asked to introduce the Session on Virus Structure and Assembly, and to present our studies on the structure of adenovirus core proteins. Prior to the meeting, this Investigator met with several European colleagues to discuss methods of protein sequence analysis, the function of human heat shock proteins, and virus structure and assembly. Tentative plans for collaborative research projects were made with several colleagues.

1373 (LA-UR–89-3232) **The GTP binding protein-dependent activation and deactivation of cGMP phosphodiesterase in rod photoreceptors.** Yamazaki, Akio. Los Alamos National Lab., NM (USA). [1989]. 21p. Sponsored by U.S. DOE Management & Administration; U.S. Department of Health and Human Services. DOE Contract W-7405-ENG-36. (CONF-8910253–1: 2. international conference on cyclic nucleotide phosphodiesterase, Tokushima (Japan), 4-6 Oct 1989). Order Number DE90000687. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cyclic GMP (cGMP) has a crucial role in visual transduction. Recent electrophysiological studies clearly indicate the existence of cGMP-activated conductance in photoreceptor plasma membranes. In darkness, Na^+, Ca^{++}, and Mg^{++} enter rod outer segments (ROS) through cGMP-activated channels while light closes channels by lowering cGMP concentrations through activation of cGMP phosphodiesterase (PDE). Many excellent reviews reference the mechanism of PDE activation in photoreceptors. However, recent progress in understanding the mechanisms regulating cGMP hydrolysis has raised an important question in the PDE-regulation: how does the three-dimensional movement of a subunit of transducin (retinal G protein) relate to the PDE activation? Associated with that question, the mechanism of PDE regulation appears to vary at different stages of evolution, for example, frog and bovine photoreceptors. This review examines recent progress of the cGMP hydrolysis mechanism by focusing on the subunit interactions between transducin and PDE. 36 refs., 2 figs.

1374 (LBL–24018, pp. 37-38) **Mutagenesis - fundamental chemistry.** Hearst, J.E. Lawrence Berkeley Lab., CA (USA). Sep 1987. In *Chemical Biodynamics Division: Annual report, October 1, 1986-September 30, 1987.* Order Number DE88004886. Available from NTIS, PC A04/MF A01.

In an attempt to understand the relationship between nucleic acid structure and function surrounding mutagenesis, the author concentrates on two topics of discussion. They are: study of the action mechanism of ABC exinuclease on psoralen modified DNA substrates and analysis of the kinetics and structure of the three-strand complex of recA.

1375 **Conformations of DNA modified by aromatic amines: Minimized semiempirical potential energy calculations and model building.** Broyde, S. (Dept. of Biology, New York Univ., New York, NY (US)); Hingerty, B.E. pp. 172 of Computer simulation of carcinogenic processes. Silverman, B.D. CRC Press Inc., Boca Raton, FL (1988).

The authors have been studying aromatic amine-DNA adducts using minimized semiempirical potential energy calculations to obtain an energy ranked list of conformations for modified deoxydinucleoside monophosphates. The important low energy forms are then investigated in larger polymers by hand model building, computer modeling, and full-scale energy minimization. Their goal has been to study series of chemically related substances whose biological sequelae may differ in order to try to discern some correlation between adduct conformation and biological effect. Their methods and findings are described.

1376 **Enzyme-based fiber optic sensors.** Kulp, T.J. (Lawrence Livermore National Lab., P.O. Box 5507, L-524, Livermore, CA (US)); Camins, I.; Angel, S.M. vp of Optical fibers in medicine III. Katzir, A SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801104–: Optical fibers in medicine III, Los Angeles, CA (USA), 13-16 Jan 1988).

Fiber optic chemical sensors capable of detecting glucose and penicillin were developed. Each consists of a polymer membrane that is covalently attached to the tip of a glasss optical fiber. The membrane contains the enzyme and a pH-sensitive fluorescent dye (fluorescein). A signal is produced when the enzyme catalyzes the conversion of the analyte (glucose or penicillin) into a product (gluconic or penicilloic acid, respectively) that lowers the microenvironmental pH of the membrane and, consequently, lowers the fluorescence intensity of the dye. Each sensor is capable of responding to analyte concentrations in the range of –0.1 to 100 mM. The penicillin optrode response time is 40 to 60 s while that for glucose is –5 to 12 min.

1377 **Non-muscle contractile proteins in the organ of corti.** Thalmann, I. (Washington Univ., St. Louis, MO (USA)); Giometti, C.S.; Thalmann, R. *Abstracts of the Midwinter Research Meeting (USA),* : 66 (1985). DOE Contract W-31-109-ENG-38.

Evidence indicates that an active contractile process exists in the outer hair cells of the mammalian cochlea. Proteins ordinarily associated with muscle contraction have been identified in the outer hair cells by immunohistologic techniques. On this basis a muscle-like mechanism of contraction/relaxation has been postulated by several investigators. The possibility must be considered, however, that the contractile proteins identified thus far in inner ear structures may be nonmuscle rather than muscle forms. In skeletal muscle, actin and myosin are responsible for the physical movement of the muscle fibers, and tropomyosin and troponin are involved in regulating this movement; these four proteins, as well as a variety of proteins involved with the normal cell maintenance functions are all of a muscle-specific type. Non-muscle-like motion also depends upon the interaction of actin with myosin; however, not only are these proteins structurally different from those specific to skeletal muscle but their proportions are also different. We have used two-dimensional polyacrylamide gel electrophoresis to study the proteins in freeze dried preparations of whole organ of Corti from the guinea pig. The identified proteins include non-muscle actin, three forms of non-muscle tropomyosin, alpha- and beta-tubulin, alpha-actinin, and lactate dehydrogenase (LDH B). Myosin heavy and light chains were not detected in the organ of Corti preparation, but the levels of those proteins might be too low to be detected with the protein load used of those proteins might be too low to be detected with the protein load used for this analysis. Although troponin could not be detected, calmodulin was present. All of these findings tend to indicate that the contraction/relaxation processes that have been associated with the organ of Corti by others are of the non-muscle variety.

1378 **Spectral, photophysical, and stability properties of isolated photosystem II reaction center.** Seibert, M. (Solar Energy Research Institute, Golden, CO (USA)); Picorel, R.; Rubin, A.B.; Connolly, J.S. *Plant Physiology (USA),* 87(2): 303-306 (Jun 1988). DOE Contract AC02-83CH10093.

Photosystem II reaction center (RC) preparations isolated from spinach (Spinacea oleracea) by the Nanba-Satoh procedure are

quite labile, even at 4°C in the dark. Simple spectroscopic criteria were developed to characterize the native state of the material. Degradation of the RC results in (a) blue-shifting of the red-most absorption maximum, (b) a shift of the 77 K fluorescence maximum from ~682 nm to ~670 nm, and (c) a shift of fluorescence lifetime components from 1.3-4 nanoseconds and >25 nanoseconds to ~6-7 nanoseconds. Fluorescence properties at 77 K seem to be a more sensitive spectral indicator of the integrity of the material. The >25 nanosecond lifetime component is assigned to $P680^+$ $Phenophytin^-$ recombination luminescence, which suggest a correlation between the observed spectral shifts and the photochemical competence of the preparation. Substitution of lauryl maltoside for Triton X-100 immediately after RC isolation stabilizes the RCs and suggests that Triton may be responsible for the instability.

1379 Laser flash photolysis as a probe of redox protein-membrane interactions: Effect of binding of spinach plastocyanin and horse cytochrome c to lipid bilayer vesicles on the kinetics of reduction by flavin semiquinone. Senthilathipan, V. (Univ. of Arizona, Tucson (USA)); Tollin, G. *Biochemistry (USA)*, 28(3): 1133-1138 (7 Feb 1989).

Spinach plastocyanin binds to both electrically neutral and positively charged lipid bilayer vesicles whereas cytochrome c only binds electrostatically to negatively charged vesicles. Laser flash photolysis using lumiflavin semiquinone as a reductant demonstrates that the reactivity of plastocyanin is increased as much as 6-fold when it is membrane bound whereas the rate constant for cytochrome c reduction is decreased by approximately a factor of 3. Membrane-bound plastocyanin reduction occurs via a two-step mechanism, probably involving prior association of lumiflavin semiquinone with the bilayer. In contrast, cytochrome c reduction in the membrane-bound state follows simple second-order kinetics, implying that the redox site in the bound state is still accessible to lumiflavin semiquinone in solution, although the rate constant is decreased by approximately 3-fold. These results are interpreted as indicating that the bilayer-protein interaction with plastocyanin leads to a steric blockage of the electron-transfer site from the aqueous phase. Little or no hindrance of the redox site occurs with cytochrome c, suggesting a high degree of mobility of this protein on the bilayer surface. Although the increase in plastocyanin reactivity upon binding to the bilayer is quite interesting, its cause remains unclear and requires further study. The results illustrate the utility of laser flash photolysis as a probe of membrane-protein interactions.

1380 Altered regulation of lipid biosynthesis in a mutant of Arabidopsis deficient in chloroplast glycerol-3-phosphate acyltransferase activity. Kunst, L. (Michigan State Univ., East Lansing (USA)); Browse, J.; Somerville, C. *Proceedings of the National Academy of Sciences of the United States of America (USA)*, 85(12): 4143-4147 (Jun 1988). DOE Contract AC02-76ER01338.

The leaf membrane lipids of many plant species, including Arabidopsis thaliana (L.) Heynh., are synthesized by two complementary pathways that are associated with the chloroplast and the endoplasmic reticulum. By screening directly for alterations in lipid acyl-group composition, the authors have identified several mutants of Arabidopsis that lack the plastid pathway because of a deficiency in activity of the first enzyme in the plastid pathway of glycerolipid synthesis, acyl-ACP:sn-glycerol-3-phosphate acyltransferase. The lesion results in an increased synthesis of lipids by the cytoplasmic pathway that largely compensates for the loss of the plastid pathway and provides nearly normal amounts of all the lipids required for chloroplast biogenesis. However, the fatty acid composition of the leaf membrane lipids of the mutants is altered because the acyltransferases associated with the two pathways normally exhibit different substrate specificities. The remarkable flexibility of the system provides an insight into the nature of the regulatory mechanisms that allocate lipids for membrane biogenesis.

1381 Model for how type I restriction enzymes select cleavage sites in DNA. Studier, F.W. (Brookhaven National Laboratory, Upton, NY (USA)); Bandyopadhyay, P.K. *Proceedings of the National Academy of Sciences of the United States of America (USA)*, 85(13): 4677-4681 (Jul 1988).

Under appropriate conditions, digestion of phage T7 DNA by the type I restriction enzyme EcoK produces an orderly progression of discrete DNA fragments. All details of the fragmentation pattern can be explained on the basis of the known properties of type I enzymes, together with two further assumptions: (i) in the ATP-stimulated translocation reaction, the enzyme bound at the recognition sequence translocates DNA toward itself from both directions simultaneously; and (ii) when translocation causes neighboring enzymes to meet, they cut the DNA between them. The kinetics of digestion at 37°C indicates that the rate of translocation of DNA from each side of a bound enzyme is about 200 base pairs per second, and the cuts are completed within 15-25 sec of the time neighboring enzymes meet. The resulting DNA fragments each contain a single recognition site with an enzyme (or subunit) remaining bound to it. At high enzyme concentrations, such fragments can bu further degraded, apparently by cooperation between the specifically bound and excess enzymes. This model is consistent with a substantial body of previous work on the nuclease activity of EcoB and EcoK, and it explains in a simple way how cleavage sites are selected.

1382 Geometrical aspects of the frustration in the cubic phases of lyotropic liquid crystals. Anderson, D.M. (Univ. of Massachusetts, Amherst (USA)); Gruner, S.M.; Leibler, S. *Proceedings of the National Academy of Sciences of the United States of America (USA)*, 85(15): 5364-5368 (Aug 1988). DOE Contract FG02-87ER60522.

Bicontinuous cubic phases, composed of bilayers arranged in the geometries of periodic minimal surfaces, are found in a variety of different lipid/water systems. It has been suggested recently that these cubic structures arrive as the result of competition between two free-energy terms: the curvature energy of each monolayer and the stretching energy of the lipid chains. This scenario, closely analogous to the one that explains the origin of the hexagonal phases, is investigated here by means of simple geometrical calculations. It is first assumed that the lipid bilayer is of constant thickness and the distribution of the (local) mean curvature of the phospholipid-water interfaces is calculated. Then, assuming the mean curvature of these interfaces is constant, the distribution of the bilayer's thickness is calculated. Both calculations quantify the fact that the two energy terms are frustrated and cannot be satisfied simultaneously. However, the amount of the frustration can be smaller for the cubic phase than for the lamellar and hexagonal structures. Therefore, this phase can appear in the phase diagram between the other two, as observed in many recent experiments.

1383 Deprotonation of lipid-depleted bacteriorhodopsin. Jang, Dujeon (Univ. of California, Los Angeles (USA)); El-Sayed, M.A. *Proceedings of the National Academy of Sciences of the United States of America (USA)*, 85(16): 5918-5922 (Aug 1988). DOE Contract FG03-88ER13828.

The removal of 75% of the lipid from bacteriorhodopsin caused the following: (i) decreased efficiency and rate of deprotonation of the protonated Schiff base (as monitored by absorption of the M_{412} intermediate); (ii) increased efficiency of deprotonation of deionized samples; (iii) a decrease by 1 unit in the pH at which deprotonation ceases; (iv) increased intensity of Eu^{3+} emission in Eu^{3+}-regenerated deionized delipidated samples; (v) increased exposure of the Eu^{3+} sites to water; and (vi) elimination of the dependence of the deprotonation efficiency on the metal cation concentration. These results are discussed in terms of changes in the protein conformation upon delipidation, which in turn control the deprotonation mechanism.

1384 Directed mutagenesis indicates that the donor to P^+_{680} in photosystem II is tyrosine-161 of the D1 polypeptide. Debus, R.J. (Michigan State Univ., East Lansing (USA)); Barry, B.A.; Sithole, I.; Babcock, G.T.; McIntosh, L. *Biochemistry (USA)*, 27(26): 9071-9074 (27 Dec 1988).

Photosystem II contains two redox-active tyrosines. One of these, Y_Z, reduces the reaction center chlorophyll, P680, and transfers the oxidizing equivalent to the oxygen-evolving complex. The second, Y_D, has a long-lived free radical state of unknown function. The authors, recently established that Y_D is Tyr-160 of the D2 polypeptide by site-directed mutagenesis of a psbD gene in the unicellular cyanobacterium Synechocystis 6803. Y_Z is most likely the symmetry-related Tyr-161 of the D1 polypeptide. To test this hypothesis, they have changed Tyr-161 to phenylalanine by site-directed

mutagenesis of a psb A gene in Synechocystis. The resulting mutant assembles PSII, as judged by its ability to produce the stable Y^{+}_{D} radical, but is unable to grow photosynthetically and exhibits altered fluorescence properties. The nature of the fluorescence change indicates that forward electron transfer to P^{+}_{680} is disrupted in the mutant. These results provide strong support for our identification of Tyr-161 in the D1 polypeptide with Y_Z.

1385 **High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 1. DNA size standards and the effect of agarose and temperature.** Mathew, M.K. (Columbia Univ., New York, NY (USA)); Smith, C.L.; Cantor, C.R. *Biochemistry (USA)*, 27(26): 9204-9210 (27 Dec 1988).

Pulsed-field gel electrophoresis (PGF) subjects DNA alternately to two electrical fields to resolve DNA ranging from 10,000 base pairs (10 kb) to 10,000 kb in size. The separations are quite sensitive to a variety of experimental variables. This makes it critical to have a wide range of reliable size standards. A technique is described for preparing mixtures of bacteriophage DNA oligomers that span a size range from monomer to more than 30-mer. The relationship between size and mobility of oligomers of different bacteriophage DNA monomers is generally self-consistent. Thus, these samples can serve as primary length standards for DNAs ranging from 10 kb to more than 1,500 kb. They have been used to estimate the size of the chromosomal DNAs from various Saccharomyces cerevisiae strains and to test the effect of gel concentration and temperature on PFG. DNA resolution during PFG is slightly improved in agarose gels with small pore sizes, in contrast to continuous electrophoresis where the opposite is observed. PFG mobility is surprisingly sensitive to changes in the running temperature.

1386 **High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 2. Effect of pulse time and electric field strength and implications for models of the separation process.** Mathew, M.K. (Columbia Univ., New York, NY (USA)); Smith, C.L.; Cantor, C.R. *Biochemistry (USA)*, 27(26): 9210-9216 (27 Dec 1988).

Bacteriophage DNAs annealed into linear oligomeric concatemers were used to examine the quantitative pulsed-field gel electrophoretic behavior of different-sized DNAs as a function of electrical field strength and pulse time. Three zones of resolution are observed for increasingly larger DNAs. In the first two zones, the electrophoretic mobility decreases linearly with increasing DNA size. The separation in zone 2 is roughly twice that in zone 1. The largest DNA molecules do not resolve at all and migrate in a compression zone. Mobility in zone 1 increases linearly with the electric field strength and decreases with the inverse of the pulse time. The behavior of DNA in zone 2 is qualitatively similar. However, the effect of field strength and pulse time on the separations in each zone is quite different. The results for zone 1 are generally consistent with the predictions of several existing physical models of pulsed-field gel electrophoresis, but no model accounts for all of the observed behavior in the three zones.

1387 **High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 3. Effect of electrical field shape.** Cantor, C.R. (Columbia Univ., New York, NY (USA)); Gaal, A.; Smith, C.L. *Biochemistry (USA)*, 27(26): 9216-9221 (27 Dec 1988).

The resolution of pulsed-field gel electrophoresis is dramatically affected by the number and configuration of the electrodes used, because these alter the shape of the applied electrical fields. Here the authors present calculations and experiments on the effect of electrode position in one of the most commonly used pulsed-field gel electrophoresis configurations. The goal was to explore which aspects of the electrical field shape correlate with improved electrophoretic resolution. The most critical variable appears to be the angle between the alternate electrical fields. The most effective electrode configuration yield angles of more than 110°. A continually increasing angle between the fields produces band sharpening that greatly enhances the resolution.

1388 **High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 4. Influence of DNA topology.** Mathew, M.K. (Columbia Univ., New York, NY (USA)); Hui, Chofat; Smith, C.L.; Cantor, C.R. *Biochemistry (USA)*, 27(26): 9222-9226 (27 Dec 1988).

Pulsed-field gel electrophoresis is a powerful technique for the fractionation of linear DNA molecules with sizes above 50 kilobase pairs (kb). Here it is demonstrated that this technique is also effective for separating smaller DNAs including linear, circular, and supercoiled species. The mobilities of linear DNAs larger than 8 kb can be modulated by pulse times between 0.1 and 100 s. The mobility of supercoiled DNA molecules up to 16 kb is generally unaffected by these pulse times except that 10-s pulse times cause a small but distinct increase in the mobility. The general insensitivity of small supercoiled DNAs to pulse time presumably occurs because these species reorient so rapidly that they spend most of their time undergoing conventional electrophoresis. However, the mobilities of larger supercoiled DNAs are affected by pulse times of less than 1 s, and at 0.1 s the molecules are better resolved by pulsed electrophoresis than by ordinary electrophoresis. The mobility of 3-19 kb nicked and relaxed circular DNA molecules is also affected by pulse time but in a complex way.

5503 Cytology

1389 (DOE/FTR--90001321) **[The hematopoietic stem cell]: Foreign trip report, September 27--October 11, 1989.** Bond, V.P. Brookhaven National Lab., Upton, NY (USA). 20 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001321. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Professor T. M. Fliedner, who spent several years in the Medical Department at Brookhaven in the '50's and '60's, and who has been a research collaborator for over three decades, is currently Rector (President) of the University of Ulm. For his sixtieth birthday, the University organized a number of observances, including an International Conference in an area of science in which Dr. Fliedner pioneered. I was asked to attend, chair a session in, and participate in the Conference, "The Hematopoietic Stem Cell". This three-day Conference was attended by approximately fifty leaders in hematology and in radiobiology associated with hematology, from a number of countries on different continents. The Proceedings are to be published in the open literature. The second part of the trip was to continue collaborative work with Professor L.E. Feinendegen at the Kernforschungsanlage (Nuclear Research Installation) at Juelich, FRG. This time was spent mainly in daily and extensive discussion on the subject of radiation risks and how they should be expressed, as well as writing sessions in an effort to complete the summary manuscript that has been under development from some time. This travel was at no expense to either BNL or DOE.

5504 Genetics

Refer also to citation(s) 7, 242, 1366, 1425

1390 (AD-A--955540/0/XAB) **Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report.** Challinor, D. Smithsonian Institution, Washington, DC (USA). Jul 1978. 8p. Available from NTIS, PC A02/MF A01.

ENDANGERED SPECIES; PLANTS/endangered species; MILITARY FACILITIES/plants; PLANTS; ENVIRONMENTAL QUALITY; SURVEYS; PROGRESS REPORT

1391 (DOE/ER/60686--1) **Optimizing procedures for a human genome repository: Project summary.** Nierman, W.C. American Type Culture Collection, Rockville, MD (USA). 1989. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER60686. Order Number DE90002117. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Repositories of well-characterized cloned human DNA fragments currently exist, but at a smaller scale than necessary for any genomic project. Procedures used in these repositories cannot be expanded without modification. Automation must be incorporated wherever feasible, including such activities as DNA preparation, clone verification, data maintenance and analysis, and sample storage, recovery, and distribution. Methods to reduce the amount of sample needed for verification and storage must also be perfected.

The objective of this project has been to develop and evaluate protocols and instrumentation while establishing a pilot repository on a genomic scale. Initial emphasis has been placed on automating clone verification by analyzing restriction fragments on a DNA sequencing machine and comparing fragment sizes to those already obtained by depositors. Intrinsic to this development has been testing sample preparation, preservation, and information management. So far, these procedures have been tested using the contigs of lambda clones identified by Maynard Olson's laboratory for the *Saccharomyces cerevisiae* genome. 7 refs., 6 figs., 5 tabs.

1392 (PB–89-204465/XAB) **Biodiversity.** Wilson, E.O.; Peter, F.M. National Research Council, Washington, DC (USA). Commission on Life Sciences. 1988. 530p. Available from NTIS, PC A23/MF A01.

Library of Congress catalog card No. 87-32439. Color illustrations reproduced in black and white.

In tropical forests, on coral reefs, and in other threatened habitats, countless plant, animal, and microbial species face possible extinction - their names unknown, their numbers uncounted, their value unreckoned. Although popular attention has focused on the plight of more visible and widely known species like the whooping crane or the African elephant, most-experts agree that the loss of less-obvious organisms could be much more devastating. This is the subject of the volume. It calls attention to a most urgent global problem: the rapidly accelerating loss of plant and animal species to increasing human-population pressure and the demands of economic development. The book explores biodiversity from a wide variety of viewpoints.

5505 Metabolism

Refer also to citation(s) 1378

5506 Medicine

Refer also to citation(s) 959, 966, 1202

1393 (AD-A–209307/8/XAB) **Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis.** Rossano, M.J. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. May 1989. 121p. (AFIT/GNE/ENP–89J-1). Available from NTIS, PC A06/MF A01.

A procedure was developed for the routine monitoring of neutron dose absorbed by patients receiving x-ray therapy with high-energy electron accelerators. The source of the neutrons was photonuclear reactions. The detection system used to measure them is described. Three methods are described and compared for measuring the neutron flux by activation of thin gold foils. These included the cadmium-difference method for thermal flux determination, a cadmium-clad polyethylene moderator known to have a relatively flat response to neutrons in the energy range of interest, and a Bonner sphere set for measuring flux and the neutron energy spectrum. Results in an actual hospital installation using a BBC 45-MeV betatron revealed whole-body neutron dose rates of approximately 1.5 mrem per photon rad. Two beta counting systems were calibrated so that routine measurements of neutron dose could be estimated from foil activation data and monitored for unexpected changes.

1394 (AD-A–210014/7/XAB) **Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report.** Frederick, C.; Schwartz, E.L. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. Aug 1988. 25p. (TR–393). Available from NTIS, PC A03/MF A01.

A 3-dimensional surface-tracking algorithm is described which is used to detect the interior laminar surfaces of a solid shell. Each of these surfaces is called a peel. Successive peels may be generated, thus representing the solid shell by its tangential layers. This algorithm is based on voxel surface tracking methods, and solves the problems associated with transforming a surface tracking algorithm into a brain peeler. Also discussed is the properties of the voxel surfaces produced by this algorithm. Using the connectivity properties of these objects, we are able to convert representations into polyhedral representations without human interaction. This work is illustrated with a high resolution reconstruction of a monkey visual cortex. Additional application domains of this work are in areas in which there is a natural laminar structure to a three-dimensional solid, such as geophysics (earth strata).

1395 (DOE/FTR–90001322) **Synchrotron radiation as a tool for study of biological structure.** Sweet, R.M. Brookhaven National Lab., Upton, NY (USA). 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001322. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The availability of synchrotron radiation (SR) has extended significantly the capability of scientists who study biological structure with radiation. There are many examples of this. The high collimation of the synchrotron beam extends use of small-angle x-ray scattering to the scale accessible by light microscopes. Protein crystal structure analysis has been accomplished with crystals only 50 microns thick. Determination of atomic-resolution structures of virus particles has become almost routine with the use of synchrotron sources. The tunability of the synchrotron x-ray beam allows solution of crystal structures with only the anomalous scattering from a small number of selenium atoms used for phasing. The "white," or polychromatic nature of SR allows use of Laue photography in crystallography. With this technique one may measure diffraction data several orders of magnitude more quickly than with monochromatic methods. This presents the possibility of one's using crystallographic methods to monitor dynamic processes in crystals. Vacuum-ultraviolet spectroscopy provides a new tool for investigation especially of nucleic acid structures. Extended X-ray Absorption Fine Structure spectroscopy has become a central tool for those who study metalloproteins. 19 refs., 7 figs.

1396 (INIS-mf–11544, pp. 1-21) **Biological evaluation of ^{99m}TC cis-Pt iminoacetic acid complexes as tumour imaging agents.** Awaluddin, A. (Unit Tenaga Nuklear, Bangi, Selangor (Malaysia)); Jacobs, J.J.; Bourne, D.W.; Maddalena, D.J.; Wilson, J.G.; Boyd, D.W. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The biodistributions of three new ^{99m}Tc labelled cis-platinum bifunctional tumour imaging agents were examined in mice bearing a certain type of sarcoma between 15 minutes and 24 hours post injection. The three complexes were excreted primarily via the renal pathway into the urine but at quite different rates. All complexes had some affinity for the tumour, but complexes III had the greatest, with tumour to blood and tumour to muscle rates at 24 hours in excess of 10:1 and 18:1. Biodistribution results were calculated using Tiscon Program. Suggesting that the three complexes may be useful as tumour imaging agents. (M.E.L.).

1397 (INIS-mf–11544, pp. 32-40) **Synthesis and biodistribution of some radioiodinated diamines.** Joshua, A.V (Edmonton Radiopharmaceutical Centre, Alberta (Canada)); Sandfor, J.G.; Scott, J.R.; Muddukrishna, S.N. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

It was felt that investigations of somke side chain analogues of HIPDM [N,N,N'-trimethyl-N'-(2-hydroxy-3-methyl-5-iodo-benzyl)-1,3-propanediamine] may help elucidate some of the factors necessary for the uptake and retention of radiolabelled compounds by the brain. All compounds investigated showed significant initial brain uptake in mice. When the side chain is shortened by one carbon, there is high initial brain activity but this falls very rapidly. These results indicate that the particular side chain seen in HIPDM is important for brain retention. Several of the compounds which are reporting here, have also pancreatic uptake and the study in mece and rats are included. (M.E.L.).

1398 (INIS-mf–11544, pp. 58-63) **Influence of monofluormethylhistidine (MFMH) on the mammary adenocarcinoma M-2.** Rubio, M.C. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina)); Landa, M.E.; Targovnik, H.; Colombo, L.L.; Scolnik, A.J.; Caro, R.A. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

It was studied the influence of monofluormethyhistidine (MFMH), a irreversible inhibitor of histidine decarboxylase on the survival mice bearing mammary adenocarcinoma and its correlation with the histamine biosynthetic activity. Some preliminary results concerning the binding H-histamine to purified tumor DNA is also reported. It is considered that results indicate a possible relationship between histamine, its binding to DNA and tumor grouth. (M.E.L.).

1399 (INIS-mf–11544, pp. 129-134) **Specific activity determination of ^{125}I labelled prolactin by receptor and radioimmunological self-displacement methods.** Rivera, E.S. (Buenos Aires Univ. (Argentina). Facultad de Farmacia y Bioquimica); Coluccia, G.A.; Venturino, A.; Malkischer, S.; Caro, R.A. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

It was studied the specific activity of ^{125}i labelled prolactin by mean of self-displacement of the hormone in binding experiments, using radioimmunoassay or receptor technique. The results obtained immediately after the labelling were compared to those calculated from yield measurement through radiochromatography. The specific activity was determined by self-displacement in order to study its modification with the time elapsed after labelling. The change of specific activity with different labelling conditions and using RIA or receptor techniques for its determination was also studied. The S.A. of ^{125}I labelled prolactin as a function of time depends also on the method used for the labelling and even on every particular labelling process. Therefore we may conclude that, whenever S.A. or parameters derived from its value, such as the mass of the labelled protein, have to be used, the greatest caution must be used in order to avoid misleading results. (M.E.L.).

1400 (INIS-mf–11544, pp. 135-156) **Structure-activity studies on ^{99m}Tc phenolic aminocarboxyllic acid hepatobiliary agents.** Maddalena, D.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights (Australia). Isotope Div.); Wilson, J.G.; Snowdon, G.M. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Biodistributions of a series of eight ^{99m}Tc hydroxybenzylsarcosine (HBS) complexes were carried out in rats and their urinary and hepatobiliary excretion compared with their lipophilicities, the influence of substituent on the phenyl ring and plasma protein binding ability. The charge on the complexes was determined by electrophoresis at varying pH values. The HBS derivatives formed anionic complexes with ^{99m}Tc that excreted mainly via the urinary route. An increase in the lipophilicity of the complexes by substitution of halogens onto the phenyl ring led to an increase in serum protein binding and a decrease in the urinary output but hat no direct effect on hepatobiliary output. (Author).

1401 (INIS-mf–11544, pp. 157-164) **In vivo stability and inertness of various direct labelled and chelate-tagged protein.** Janoki, A. (Research Inst. for Radiobiology and Radiohygiene, Budapest (Hungary)); Korosi, L.; Klivenyi, G.; Spett, B. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

There were looking for methods giving precise information about composition and activity distribution of protein components, both in the initial samples and serum samples after intravenous administration. It was tested the applicability of electroimmunoassay, polyacrilamide gel electrophoresis and high performance liquid chromatography for the assessment of in vivo stability and labelled proteins. The model compound was human serum albumin (HSA) labelled with ^{99m}Tc and ^{125}I, respectively. Bifunctional chelate labelling was done with desferrioxamine, in this case protein was labelled with ^{67}Ga. Biodistribution of the labelled compounds and their elimination from the blood were studied in rabbits. Experience with various labelling proteins, especially with Tc-Sn-HSA system indicate that in vivo stability of this compounds are generally low. Following intravenous injection of proteins labelled with metal isotopes, due to dilution and to the presence of considerable amount of compatitive protein in the serum, part of the label is being detached from the carrier protein. Distribution of the detached metal is different from the original distribution of the protein. This problem arises also with radiopharmaceuticals based on monoclonal antibodies. (M.E.L.).

1402 (LA-UR–89-3265) **Effects of spatial attention on the visual-evoked neuromagnetic response.** Aine, C.J.; George, J.S.; Oakley, M.T.; Medvick, P.A.; Flynn, E.R. Los Alamos National Lab., NM (USA). [1989]. 10p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8905226–1: 9. international conferencew on event-related potentials of the brain, Noordwijk (Netherlands), 28 May - 3 jun 1989). Order Number DE90000680. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A number of studies have shown that selective attention to spatial location modulates the amplitudes of several visual evoked potential components recorded from posterior regions of the head (e.g., Eason, Harter & White, 1969; Harter, Aine, & Schroeder, 1982; Hillyard & Munte, 1984; Mangun & Hillyard, 1988). The early components, P1 and N1 (peak latencies: 90–135 and 140–170 msec, respectively), are thought to arise in one or more areas of visual cortex. Although it is generally assumed that such ERP effects reflect differential activation of populations of neurons at successive levels of the nervous system, little information is available about the neural structures responsible for such effects. We have employed neuromagnetic techniques in an attempt to identify more precisely the neural structures involved in selective attention to spatial location within the P1-N1 time sequence. In this study, effects of attention were assessed by comparing neural responses evoked by stimuli at a specified spatial location when subjects were required to attend and respond behaviorally to that location with neural responses to the same stimuli when subjects were required to attend and respond behaviorally to another location in the visual field. 7 refs., 3 figs.

1403 (PB–89-215768/XAB) **Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report.** American Coll. of Radiology, Chicago, IL (USA). 28 Sep 1984. 90p. Available from NTIS, PC A05/MF A01.

Activities carried out by the American College of Radiology are described. Guidelines on radiographic techniques for radiological technicians were developed. Annual training sessions for technologists and physicians were conducted by the American College of Radiology Task Force on Pneumoconiosis. Regulations for performing chest x rays were reviewed. Program activities such as the 12-point International Labor Organization (ILO) classification scale for diagnosis of coal workers' pneumoconiosis, and the reporting form for use of the 1980 ILO classification system were reviewed. The American College of Radiology maintained liaison between NIOSH and other medical specialty societies such as the American College of Chest Physicians, the College of American Pathologists, the American Medical Association, and the American Osteopathic College of Radiology. The American College of Radiology assisted NIOSH with the initiation, development, and maintenance of a quality control method to monitor and advise physicians on the reading of radiographs.

1404 (PB–89-860696/XAB) **Computerized tomography: Technology and equipment. March 1988-April 1989 (Citations**

from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for March 1988-Apr 1989. National Technical Information Service, Springfield, VA (USA). May 1989. 41p. Available from NTISPC N01/MF N01.

Supersedes PB–88-858782. See also PB–89-860688.

This bibliography contains citations concerning the instrumentation, technology, and applications of computerized tomography (CT). Production-model CT scanners are compared and evaluated for noise, spatial resolution, axial position sensitivity, artifact, and dose. Research and development efforts of equipment and applications are discussed. (This updated bibliography contains 52 citations, all of which are new entries to the previous edition.)

1405 (ZfK–584, pp. 87) **First investigations with a stationary positron camera.** Manfrass, P.; Fromm, W.D.; Sobiella, M.; Wohlfarth, D. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. POSITRON CAMERAS/performance testing; POSITRON CAMERAS/positron computed tomography; COINCIDENCE SPECTROMETRY; IMAGE CONVERTERS; IMAGE PROCESSING; MULTIWIRE PROPORTIONAL CHAMBERS; RATS; SKELETON; SPATIAL RESOLUTION; SPECIFICATIONS

1406 **Sequential rat blood boron concentration measurements method using CR-39 SSNTDs.** Mengers, T.F.; Blue, T.E.; Curran, J.F.; Carey, W.E.; Barth, R.F. *Transactions of the American Nuclear Society (USA),* 57: 80-82 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Boron neutron capture therapy (BNCT) has been used as an experimental modality for the treatment of a highly malignant form of human brain cancer, glioblastoma multiforme. The success of BNCT is currently being tested at our institution using an anaplastic glioma clone transplanted into the caudate nucleus of Fischer rats, as a model for glioblastoma multiforme in humans. Since the blood boron concentration at the time of neutron irradiation must be low in order for BNCT to be successful, we have developed a solid-state nuclear track detector (SSNTD)-based sequential assay technique for measuring ^{10}B concentrations in the blood of rats. With our technique, many blood samples can be taken from a single rat, thus reducing the uncertainty at different time points, due to biological variability among rats, which is inherent is assay techniques with which one can obtain only one data point per rat. The purpose of this paper is to describe the assay technique and to illustrate its usefulness by providing representative data from an ongoing pharmacokinetic study.

1407 **Effect of fatty acyl chain length and structure on the lamellar gel to liquid-crystalline and lamellar to reversed hexagonal phase transitions of aqueous phosphatidylethanolamine dispersions.** Lewis, R.N.A.H. (Univ. of Alberta, Edmonton (Canada)); Mannock, D.A.; McElhaney, R.N.; Turner, D.C.; Gruner, S.M. *Biochemistry (USA),* 28(2): 541-548 (24 Jan 1989). DOE Contract FG02-87ER60522.

The lamellar gel/liquid-crystalline and the lamellar liquid-crystalline/reversed hexagonal phase transitions of aqueous dispersions of a number of synthetic phosphatidylethanolamines containing linear saturated, branched chain, and alicyclic fatty acyl chains of varying length were studied by differential scanning calorimetry, ^{31}P nuclear magnetic resonance spectroscopy, and X-ray diffraction. For any given homologous series of phosphatidylethanolamines containing a single chemical class of fatty acids, the lamellar gel/liquid-crystalline phase transition temperature increases and the lamellar liquid-crystalline/reversed hexagonal phase transition temperature decreases with increases in hydrocarbon chain length. For a series of phosphatidylethanolamines of the same hydrocarbon chain length but with different chemical structures, both the lamellar gel/liquid-crystalline and the lamellar liquid-crystalline/reversed hexagonal phase transition temperatures vary markedly and in the same direction. These results suggest that for any given hydrocarbon chain length, there may be a critical thickness at which the liquid-crystalline phosphatidylethanolamine bilayer becomes unstable with respect to inverted nonbilayer phases such as the H_{II} phase and that the temperature at which this critical thickness is reached is dependent upon that bilayers proximity to the hydrocarbon chain-melting phase transition temperature.

1408 **Crystallization of isoelectrically homogeneous cholera toxin.** Spangler, B.D. (Argonne National Laboratory, IL (USA)); Westbrook, E.M. *Biochemistry (USA),* 28(3): 1333-1340 (7 Feb 1989). DOE Contract W-31-109-ENG-38.

Past difficulty in growing good crystals of cholera toxin has prevented the study of the crystal structure of this important protein. The authors have determined that failure of cholera toxin to crystallize well has been due to its heterogeneity. They have now succeeded in overcoming the problem by isolating a single isoelectric variant of this oligomeric protein (one A subunit and five B subunits). Cholera toxin purified by their procedure readily forms large single crystals. The crystal form has been described previously. They have recorded data from native crystals of cholera toxin to 3.0-Å resolution with our electronic area detectors. With these data, they have found the orientation of a 5-fold symmetry axis within these crystals, perpendicular to the screw dyad of the crystal. They are now determining the crystal structure of cholera toxin by a combination of multiple heavy-atom isomorphous replacement and density modification techniques, making use of rotational 5-fold averaging of the B subunits.

5507 Microbiology

Refer also to citation(s) 7, 8, 1339, 1366

5509 Pathology

Refer also to citation(s) 1368, 1412, 1445, 1457, 1459

1409 (PB–89-860803/XAB) **Chromium toxicity. January 1987-April 1989 (Citations from the Life Sciences Collection data base). Report for January 1987-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 35p. Available from NTISPC N01/MF N01.

Supersedes PB–88-856281.

This bibliography contains citations concerning the biological effects of chromium exposure. The effects on protein metabolism and kidney and liver functions are discussed, and the role of chromium as a carcinogenic agent and its antigenicity are also considered. Sources of chromium contamination including occupational exposure and pollution are discussed, and methods of analysis are described. (This updated bibliography contains 59 citations, 26 of which are new entries to the previous edition.)

5510 Physiological Systems

1410 **Standard energy metabolism of a desert harvester ant, Pogonomyrmex rugosus: Effects of temperature, body mass, group size, and humidity.** Lighton, J.R.B. (Univ. of California, Los Angeles (USA)); Bartholomew, G.A. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(13): 4765-4769 (Jul 1988).

Pogonomyrmex rugosus is an important seed predator in the Mojave Desert of the southwestern United States. Its standard rate of O_2 consumption (Vo_2) varied significantly with temperature. The ratio of the Vo_2 values at 10°C increments in body temperature, Q_{10}, also varied with temperature; methods of calculating Vo_2 from temperature with a shifting Q_{10} are described. Vo_2 also varied with body mass. Vo_2 was inversely related to relative humidity and was independent of group size. The rise in Vo_2 at low relative humidities was caused by increased activity and resulted in higher rates of net water loss. The primary metabolic adaptation to xeric conditions in P. rugosus appears to be a lower-than-predicted metabolic rate.

5520 Public Health

Refer also to citation(s) 202, 1269, 1270, 1271, 1272, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1460

1411 (PB–89-216055/XAB) **Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976.** Wolf, F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 17 May 1976. 3p. (IWS–057.10). Available from NTIS, PC A02/MF A01.

A walk-through industrial hygiene survey of the wet chemical operation was conducted at CF Chemicals, Inc., Bartow, Florida on May 17, 1976, as part of an industry-wide study of the phosphate-fertilizer industry. Potential health hazards include sulfur dioxide, sulfuric acid mist, phosphoric acid, ammonia gas, radon daughters, and fluoride. These potential hazards exist under upset conditions. Potential exposure to dusts and radon daughters at the rock-handling area is the only one where routine exposure could be expected.

1412 (PB–89-860928/XAB) **Lead exposure: public and occupational health hazards. January 1978-April 1989 (Citations from Pollution Abstracts). Report for January 1978-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 124p. Available from NTISPC N01/MF N01.

Supersedes PB–86-865698.

This bibliography contains citations concerning the effects of chronic lead exposure. Occupational hazards, automobile emissions, and air pollution and their relation to lead toxicity are cited. Lead absorption in children is discussed. The clinical features of lead toxicity are noted and biochemical assays for the quantitation of blood and tissue lead levels are discussed. D-aminolevulenic acid dehydratase and its relation to blood lead levels is cited. Animal studies are noted. (This updated bibliography contains 271 citations, 111 of which are new entries to the previous edition.)

5530 Agriculture and Food Technology

Refer also to citation(s) 1419

1413 (CRIE-U–88037) **Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant.** Terawaki, Toshinobu. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1988. 27p. (In Japanese). Order Number DE89901294. Available from NTIS (US Sales Only), PC A03/MF A01.

Kelp forest becomes important recently from the view points of fisheries resources protection and environmental protection. In this report, size and settlement time of the experimental substratum (natural rocks and concrete blocks) for the artificial algal substratum on sand soil were estimated from the results of site survey on the growth of Ecklonia cava at the mouth of a bay, Miura peninsula, Kanagawa Prefecture. Furthermore, effective surface form of the artificial substratum for colonization of young Ecklonia plant was studied. Dominant algal species of rocky sea bottom were Eisenia bicyclics at 3-4m and Ecklonia cava at 5-10m in water depth. As surface area of substratum become larger, number, maximum plant length and wet weight of E. cava plant growing on them were increased, and at about 2000cm^2 they reached nearly same values as the natural polation on rocky surface. Therefore, more than 2000cm^2 will be required. The plant length of large-sized plant of E. cava increased during the period from winter to summer, but middle-and small-sized plant of E. cava showed continuous increase during the year. Maintenance and renovation of E. cava population were depended on the growth of middle-and small-sized plant. 5 refs., 13 figs., 2 tabs.

1414 (DOE/RL/11396–1) **[Alaskan commodities irradiation project: An options analysis study]: Final technical report.** Zarling, J.P.; Swanson, R.B.; Logan, R.R.; Das, D.K.; Lewis, C.E.; Workman, W.G.; Tumeo, M.A.; Hok, C.I.; Birklind, C.A.; Bennett, F.L. Alaska Univ., Fairbanks, AK (USA). Inst. of Northern Engineering. Sep 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FC06-87RL11396. Order Number DE90002116. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The ninety-ninth US Congress commissioned a six-state food irradiation research and development program to evaluate the commercial potential of this technology. Hawaii, Washington, Iowa, Oklahoma and Florida as well as Alaska have participated in the national program; various food products including fishery products, red meats, tropical and citrus fruits and vegetables have been studied. The purpose of the Alaskan study was to review and evaluate those factors related to the technical and economic feasibility of an irradiator in Alaska. This options analysis study will serve as a basis for determining the state's further involvement in the development of food irradiation technology.

1415 (DOE/RL/11396–T1) **Alaskan Commodities Irradiation Project: An options analysis study.** Zarling, J.P.; Swanson, R.B.; Logan, R.R.; Das, D.K.; Lewis, C.E.; Workman, W.G.; Tumeo, M.A.; Hok, C.I.; Birklid, C.A.; Bennett, F.L. Alaska Univ., Fairbanks, AK (USA). Inst. of Northern Engineering. 1 Dec 1988. 374p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FC06-87RL11396. Order Number DE90001723. Available from NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.

The ninety-ninth US Congress commissioned a six-state food irradiation research and development program to evaluate the commercial potential of this technology. Hawaii, Washington, Iowa, Oklahoma and Florida as well as Alaska have participated in the national program; various food products including fishery products, red meats, tropical and citrus fruits and vegetables have been studied. The purpose of the Alaskan study was to review and evaluate those factors related to the technical and economic feasibility of an irradiator in Alaska. This options analysis study will serve as a basis for determining the state's further involvement in the development of food irradiation technology. 40 refs., 50 figs., 53 tabs.

1416 (ORNL/FTR–3398) **[Field-scale water and solute flux in soils]: Foreign trip report, September 21–30, 1989.** Luxmoore, R.J. Oak Ridge National Lab., TN (USA). 19 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001539. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler evaluated and discussed research results of Mr. Andreas Papritz, a graduate student in soil physics, at the request of the Department Head, Professor Dr. Hannes Fluhler of the Swiss Federal Institute of Technology. He also participated in an international workshop on water and solute transport in field soils by giving an invited presentation, chairing a session, and contributing to a discussion group dealing with preferential flow processes in field soils. 10 refs.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 166, 386, 410, 504, 540, 1284, 1399, 1400, 1834, 1841, 1842, 1843, 1844, 1846, 1847

1417 (AD-A–209663/4/XAB) **Differential sensitivity of human leukocyte subpopulations to ultraviolet light.** Spielberg, H.; June, C.; Cereb, N.; Nystrom-Rosander, C.; Deeg, H.J. Naval Medical Research Inst., Bethesda, MD (USA). Feb 1989. 3p. (NMRI–89-24). Available from NTIS, PC A02/MF A01.

Pub. in Transplantation Proceedings, Vol. 1, No. 21, 180-181(Feb 1989).

Ultraviolet (UV) light, in addition to its effect on DNA, can cause cell-membrane alterations and modification of cell surface antigens, and interfere with interactions of different cell populations, antigen presentation, and cytokine release. The mechanisms are still poorly understood. However, current data indicate that UV irradiation profoundly affects donor/host interactions in transplantation models by altering the immunogenicity of donor tissue and the immune response of the recipient. In the present study we used intracellular Ca^{2+} (Ca^{2+}i) mobilization as a parameter of how various cell populations responded to UV light. These data show that UV treatment profoundly affects leukocytes. There is a preferential inhibition of

lymphocytes compared to hemopoietic precursor cells and of CD^{8+} compared to CD^{8-} negative T-cells.

1418 (AD-A-209902/6/XAB) **Ultraviolet-induced photochemical damage in the ocular tissues. Final report.** Zuclich, J.A. Krug International, San Antonio, TX (USA). Technology Services Div. May 1989. 14p. Available from NTIS, PC A03/MF A01.

Pub. in Health Physics, Vol. 56, No. 5, 671-682(May 1989).

Exposure to ultraviolet lasers may result in pathology to either the cornea, lens, or retina of the primate eye. The particular combination of exposure parameters (wavelength, peak power, pulsewidth, pulse repetition rate and total energy delivered) determine the target tissue(s) in each instance. The effect may be acute or chronic, and the implicated damage mechanism categorized as photochemical, photoablative or thermal. This discussion summarizes a number of specific cases where ultraviolet-laser radiation affected the cornea, lens and/or retina; will describe the nature of the pathologies; and will indicate what is known about the damage mechanisms in each case. Ranges of exposure parameters where each ocular tissue is the most sensitive will be defined. Data discussed include the action spectra for far- and near-ultraviolet induced ocular damage; the pulse width and total energy dependencies of corneal and lens thresholds; cumulative effects of repeated ultraviolet exposures and repair or recovery rates. Finally, retinal photoreceptor damage resulting from near-UV laser exposures is described. This apparent photochemical effect was observed following exposure to a 325-nm helium cadmium laser when 0.28 J was delivered to the eye.

1419 (BMVg-FBWM–89-1) **Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report.** Kaltenhaeuser, A.; Werner, K.H. Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Bundesministerium der Verteidigung, Bonn (Germany, F.R.). 1989. 41p. (In German). Contract R-66.753;IN SAN I 1687-V-4387. Available from Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw).

The effect of nuclear radiation on the toxicity and the molecular structure of the toxin produced by the microorganism Clostridium botulinum type A was investigated. The radiation induced changes in the structure of the toxin molecule. This effect is influenced by the composition or the medium above the toxin solution as well as by the temperature during the irradiation. The results of the investigation indicate that with increasing irradiation dose a new molecule was formed with immunological properties similar to the properties of the original molecule however with a greater molecular weight. After exposure to a radiation dose of 3,4 Mrad at normal temperature in air, complete detoxification of the substance was found. Immunizing experiments with the toxoid with two guinea-pigs indicated a pronounced increase of the antibody titer in the serum after 4 weeks. Vaccination experiments with the toxoid on animals show, that the protection against the effect of the toxin corresponds to the demands of the European Pharmacopoeia. The efficiency of the toxoid shows a similar efficiency as toxoids produced by chemical methods. The production of a toxoid-viccine with the relatively simple method of nuclear radiation appears possible. (orig./MG) With 12 refs., 3 tabs., 11 figs.

1420 (BMVg-FBWM–89-2) **Investigations on human blood cells for the diagnosis of radiation damage. Final report.** Gloebel, B.; Gloebel, H. Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik; Bundesministerium der Verteidigung, Bonn (Germany, F.R.). 1989. 85p. (In German). Contract IN SAN I 1284-V-3885. Available from Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw).

In case of defence most of the soldiers (and civilians) will not be supplied with a physical dosimeter. Therefore, it is necessary to develop new methods to see a correlation between endogenic data of individuals and the received radiation dose. Then we will be able to initiate, if necessary, a medical treatment or other countermeasures. The automatic cytometry with computer aid in depositary technique is used to analyse the reticulocytes, leucocytes and other blood cells in the peripheral blood. Target group are patients which obtain whole body irradiation (I-131) or external partial body irradiation between 0.5 and 3 Gy because of carcinoma therapy. Until now 361 patients with external radiation of the head, thorax and abdominal region and also internal radiation with I-131 have been interpreted. (orig.) With 14 refs., 4 tabs., 52 figs.

1421 (BMVg-FBWM–89-7) **Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report.** Buschmann, H.; Kleinschmidt, A.; Koeppel, P.; Winter, M. Muenchen Univ. (Germany, F.R.); Bundesministerium der Verteidigung, Bonn (Germany, F.R.). 1989. 102p. (In German). Contract IN SAN I 1283-V-3885. Available from Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw).

In experiments with mice and pigs a sublethal irradiation before vaccination proved to be by far more efficient than an irradiation with the same dose following vaccination. In the irradiated animals a retarded beginning of the immune response compared with the controls was observed. In the experiments with mice positive effects of the adjuvant azimexon and levamisol on the radiation induced immunosuppression was seen. In the experiments with pigs the radiation iduced immunosuppression was completely abolished by addition of incomplete Freund adjuvant to the antigen. Azimexon as adjuvant was efficient both when given before or after exposition. Post-endotoxic serum from BCG-infected animals (BCG/ET) had only a weak effect in animals immunized before exposition. Serum immunoglobulin levels of pigs were stable against irradiation and application of immunomodulating agents. Stimulation effects of the irradiation on the antibody response were observed in mice and pigs if the animals were first immunized and irradiated afterwards. In the irradiated pigs the mitogenic stimulation of T and B cells was depressed. After application of azimexon the stimulation of T cells was significantly increased in irradiated pigs; the impaired B cell stimulation, however, remained unaltered. By using the monoclonal antibody technique functionally distinct subpopulations of peripherals lymphocytes in swine were detected, each showing a different sensibility towards in vivo irradiation. (orig.) With 10 refs., 21 figs.

1422 (CONF-891103–11) **The continuing evolution of the Federal Radiological Emergency Response Plan.** Gant, K.S.; Adler, M.V.; Wolff, W.F. Oak Ridge National Lab., TN (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89014075. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper briefly describes the Federal Radiological Emergency Response Plan (FRERP) and DOE's role under that plan. The experience gained since the plan was published in 1985 in responding to real events and in exercises is being incorporated into current efforts to revise the FRERP. 1 ref.

1423 (CONF-8804141–9) **Physical and chemical interactions in irradiated water containing DNA.** Wright, H.A.; Hamm, R.N.; Turner, J.E.; Klots, C.E.; Bolch, W.E. Oak Ridge National Lab., TN (USA). [1988]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 11. Werner Brandt workshop on charged particle penetration phenomena; Oak Ridge, TN (USA); 14-15 Apr 1988. Order Number DE90000573. Available from NTIS, PC A02/MF A01 - OSTI.

When a charged particle interacts with liquid water it undergoes inelastic energy loss events that produce ionizations and excitations of water molecules. The electrons produced during ionization events may have enough energy themselves to produce further ionizations and excitations in slowing down to subexcitation energies. These physical interactions occur very rapidly – within 10^{-15}s in a local region of space – and result in the production of ionized water molecules (H_2O^+), excited water molecules (H_2O^*) and subexcitation electrons. During the prechemistry period to approximately 10^{-12}s chemically reactive ions and radicals are formed. Subsequently, these ions and radicals diffuse through the water and react chemically with each other or with other molecules that may be present in solution. We have developed a Monte Carlo computer code to simulate these physical and chemical processes in liquid water. 10 figs., 4 tabs.

1424 (DOE/ER/60409–4) **Modulation of lymphopoiesis: Annual report.** Rosse, C. Washington Univ., Seattle, WA (USA). Dept.

of Biological Structure. 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER60409. Order Number DE90001488. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We examined the effects of progressive growth of CE 1460 on natural killer (NK) cell activity both in the bone marrow, the site of primary NK cell production, and in a peripheral site, the spleen. (BALB/c x CE)F_1 mice were injected subcutaneously with trypsinized cells from in vivo passaged CE1460 or from B66, a BALB/c mammary carcinoma that does not induce neutrophilia. 3 days post-tumor implantation, NK activity in bone marrow cells or spleen cells was greatly enhanced compared to normal controls. In B66 tumor-bearing mice, NK activity returned to normal by Day 7 and remained there through Day 14. In contrast, however, NK activity in CE1460 tumor-bearing mice decreased to only to 10-20% of normal by Day 14. Excision of the tumor on Day 14, when WBC counts were three times normal, was followed by a rapid return of the WBC count to the normal range. NK activity in bone marrow and in spleen cells recovered somewhat but was still significantly suppressed 7 days after tumor excision. Limiting dilution analysis revealed a 3-5-fold decrease in frequency of NK precursors in bone marrow cells of mice bearing CE1460 for 7 to 14 days. The dramatic changes in NK activity observed in these experiments may reflect perturbation in production as well as an initial activation and subsequent suppression of mature NK cells.

1425 (DOE/ER/60539–T2) **The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990.** Burns, F.J.; Garte, S.J. New York Univ., NY (USA). Dept. of Environmental Medicine. [1989]. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60539. Order Number DE90001522. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

Progress is described in three areas corresponding to the specific aims of the proposal: (1) carcinogenesis and DNA strand breaks in rat skin following exposure by the neon ions or electrons; (2) oncogene activation in radiation-induced rat skin cancers; (3) DNA strand breaks in the epidermis as a function of radiation penetration.

1426 (DOE/ER/60636–T1) **The effect of radiation penetration on DNA single-strand breaks in rat skin explants.** Hosselet, S.C. Johns Hopkins Univ., Baltimore, MD (USA). [1989]. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60636. Order Number DE90001453. Available from NTIS, PC A03/MF A01; OSTI; INIS.

In vivo, ionizing radiation has been shown to cause DNA strand breaks in rat epidermis. The purpose of these experiments was to determine whether an observed difference in the number of single strand DNA breaks induced by deep as compared with shallow penetration irradiations of rat skin during in vivo experiments was also present in skin explants. In this study the effect of radiation penetration upon the induction of single-strand DNA breaks in skin explants from young, Sprague-Dawley rats was investigated. Male, 28 day old animals were pre-labelled with ^3H thymidine for 48 hours prior to irradiation. Immediately before irradiation the dorsal surface of the rats was shaved and, after sacrifice, explants of approximately 4 cm^2 were taken from the shaved area. The explants were subjected to either 12 Gy. or 24 Gy. of electron radiation at penetrations of 0.5 mm or 1.0 mm for shallow and deep penetrations respectively. After irradiation the remaining hair was removed with depilatory wax, the epidermal cells were harvested from the explant, lysed, and the DNA eluted under alkaline elution conditions to measure the breakage of the DNA. 18 refs., 5 figs.

1427 (DOE/FTR–90001724) **[Biological applications of synchrotron radiation]: Foreign trip report, August 13–19, 1989.** Sweet, R.M. Brookhaven National Lab., Upton, NY (USA). 20 Oct 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001724. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

I traveled to Korea at the invitation of the directors of the Pohang Light Source to speak at their second annual Users' Meeting. I lectured on the uses that can be made of synchrotron radiation in the study of biological structure. In addition, I consulted with my Korean counterpart regarding design of beamlines for biological studies. The attempt to construct this synchrotron in Korea is very interesting. Substantial funds are being provided by private industry, but they are sufficient to provide a truly fine machine. The scientists are struggling to justify either making a barely adequate one or to convince their government to support the effort to make a good one.

1428 (EGG-BNCT–8353-Vol.3-No.5) **PBF/BNCT [Power Burst Facility/Boron Neutron Capture Therapy] Program for cancer treatment: Bulletin.** Dorn, R.V. III. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1989. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002077. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Highlights of the PBF/BNCT Program during May include progress within the areas of: gross boron analysis in tissue blood and urine; analytical methodologies development for BSH (sodium borocaptate) purity determination; boron microscopic (subcellular) analytical development; noninvasive boron quantification determination; dosimetry; and analytical radiation transport and interaction modeling for BNCT.

1429 (EGG-BNCT–8353-Vol.3-No.6) **PBF/BNCT [power burst facility/boron neutron capture therapy] program for cancer treatment: Volume 3, No. 6.** Dorn, R.V. III. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jun 1989. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. Order Number DE89016193. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Highlights of the PBF/BNCT Program during June include progress within the areas of gross boron analysis in tissue, blood, and urine; analytical methodologies development for BSH (sodium borocaptate) purity determination; boron microscopic (subcellular) analytical development; noninvasive boron quantification determination; dosimetry; and analytical radiation transport and interaction modeling for BNCT.

1430 (EGG-BNCT–8353-Vol.3-No.7) **PBF/BNCT program for cancer treatment: Volume 3, No. 7, Bulletin.** Dorn, R.V. III. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jul 1989. 44p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002149. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Highlights of the PBF/BNCT Program during July include progress within the areas of gross boron analysis in tissue, blood, and urine, analytical methodologies development of BSH (Sodium Borocaptate) purity determination, boron microscopic (Subcellular) analytical development, noninvasive boron quantification determination, dosimetry.

1431 (HW–26471) **Review of activities of the national committee on radiation protection.** Jerman, P.C. Hanford Works, Richland, WA (USA). 27 Oct 1952. 7p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. (CONF-521001–Summ.: Health physics conference, Idaho Falls, ID (USA), 16-18 Oct 1952). Order Number DE89015539. Available from NTIS, PC A02/MF A01 - OSTI.

The writer attended the Health Physics Conference sponsored by the Atomic Energy Commission, Division of Biology and Medicine, held October 16, 17, and 18, 1952 at Idaho Falls, Idaho. This report is intended to give the highlights of this conference. The roots of the National Committee on Radiation Protection go back to 1929 at which time it was organized as the Advisory Committee on X-ray and Radium protection. Its scope of action until the advent of atomic energy was directed primarily to medical needs. In 1946 the committee was enlarged and the name changed to the National Committee on Radiation Protection. Today the Main Committee is made up of representatives of many organizations, including US Public Health Service, Atomic Energy Commission, National Electrical Manufacturers Association, American Medical Association, Radiological Society of North America, America Roentgen Ray Society, American Radium Society, Department of Defense, and National Bureau of Standards. It is quite likely that other organizations will be added as the need develops. It may prove desirable to include representatives of the labor unions in that it is essential to produce codes which, on the one hand are acceptable to unions

and on the other hand will not provide then with unreasonable levers with which to obtain undeserved fringe benefits.

1432 (INIS-mf–11544, pp. 165-169) **Biodistribution and dosimetric evaluation of ^{186}Re hydroxy ethylen diphosphate.** Noto, M.G. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Manzini, Alberto. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (In Spanish). (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Porceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The pharmacokinetics and the dose of radiation absorbed in different body tissues by the administration of ^{186}Re HEDP (hydroxyethylendiphosphate). The radiation dose in the standard man was established between 5,5 and 25 rad/mCi for red marrow, and red marrow and bone respectively; the radiation dose in metastases would be of 125 rad/mCi. It is concluded that this radiopharmaceutical is suitable for palliative treatment for pain with the mentioned patollogy. (M.E.L.).

1433 (INIS-mf–11544, pp. 170-183) **Methodology for the evaluation of decontaminant drugs at in vitro systems.** Fernandez de Giorgi, Cristina (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Dubner, Diana; Gomez Parada, Ines. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (In Spanish). (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

An experimental system was developed in order to facilitate the study of the action of decontaminant drugs in hepatic tissue. Three stages are distinguished: (1) The isolation and the hepatocytes culture in the presence of a chelant agent. (2) The obtainment of the soluble cytoplasmic fraction and its chromatographyc analysis. (3) The comparison of the behaviour of the chelant agent in in vivo and in vitro of the mentioned fraction. ^{144}CeCl was employed as a radionuclide and DTPA $CaNa_3$ as a decontaminant agent. The preliminary results of the mechanism of action of the decontaminant obtained by chromatography shows a different distribution of the radionuclide between compounds of high and low molecular weight, in the hepatocytes incubated in the presence of the chelant concerning the controls. (M.E.L.).

1434 (IPEN-PUB–255) **Nursering assistance to the radiological accident patients in Goiania-an experience report.** Graciotti, M.E. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Jun 1989. 52p. (In Portuguese). Order Number DE90606536. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

In September, 1987, a caesium-137 source was disrupted and caused a serious radiological acident. The victims were hospitalized in the General Hospital in city of Goiania, Goias state, Brazil. This is a report of a personal experience, during the two months of nursing care. (author).

1435 (LBL–27638) **Focal heavy charged particle irradiation of the mammalian cortex: Temporal pattern of changes followed by magnetic resonance imaging and positron emission tomography.** Lo, E.H.; Frankel, K.A.; Poljak, A.; DeLaPaz, R.L.; Phillips, M.H.; Woodruff, K.H.; Brennan, K.M.; Valk, P.E.; Fabrikant, J.I. Lawrence Berkeley Lab., CA (USA). Aug 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905227–1: International conference on radiosurgery a neurosurgical approach to intracranial lesions, Charlottesville, VA (USA), 1-5 May 1989). Order Number DE90001140. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Studies in progress examine the radiation response of the normal rabbit brain to accelerated focal charged particle (helium, 230 MeV/u) beams. We have demonstrated that we can produce well-defined focal lesions that are detectable on nuclear magnetic resonance (NMR) and positron emission tomography (PET) imaging procedures in the rabbit brain. These lesions appear to be similar to those observed in humans following stereotactic heavy charged particle radiosurgery. The rabbit does not deteriorate neurologically with the appearance of these deep white matter lesions thereby permitting the examination of the cerebrovascular and metabolic basis of delayed radiations injury in the brain in vivo. The following report describes radiation-induced alterations in the rabbit brain observed with NMR and PET in vivo and the corresponding histopathological correlations.

1436 (LBL–27728) **The carcinogenic risks of low-LET and high-LET ionizing radiations.** Fabrikant, J.I. Lawrence Berkeley Lab., CA (USA). Aug 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8908169–1: 32. annual meeting of the Japan Radiation Research Society, Kitakyushu-shi (Japan), 29 Aug 1989). Order Number DE90001540. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

New information is available concerning the carcinogenic effects of radiation and the implications for risk assessment and risk management. This information comes from further follow-up of the epidemiological studies of the Japanese atomic bomb survivors, patients irradiated medically for cancer and allied conditions, and workers exposed in various occupations. In the Japanese atomic bomb survivors the carcinogenic risks are estimated to be somewhat higher than previously, due to the reassessment of the atomic-bomb dosimetry, further follow-up with increase in the number of excess cancer deaths, particularly in survivors irradiated early in life, and changes in the methods of analysis to compute the age-specific risks of cancer. Because of the characteristics of the atomic bomb survivor series as regards sample size, age and sex distribution, duration for follow-up, person-years at risk, and type of dosimetry, the mortality experience of the atomic bomb survivors was selected by the UNSCEAR Committee and the BEIR V Committee as the more appropriate basis for projecting risk estimates for the general population. In the atomic bomb survivors, the dose-effect relationship for overall cancer mortality other than leukemia is consistent with linearity below 3 Gy, while the dose-effect relationship for leukemia, excluding chronic lymphatic leukemia, conforms best to a linear-quadratic function. The shape of the dose-incidence curve at low doses still remains uncertain, and the data do not rule out the possible existence of a threshold for an neoplasm. The excess relative risk of mortality from all cancers combined is estimated to be 1.39 per Gy (shielded kerma), which corresponds to an absolute risk of 10.0 excess cancer deaths per 10,000 PYGy; the relative risks is 1.41 at 1 Gy (organ-absorbed dose), and an absolute risk of 13.07 excess cancer deaths per 10,000 PYGy. 19 refs.

1437 (UCRL–101507) **Simulation of atmospheric dispersion of radioactivity from the Chernobyl accident.** Lange, R.; Sullivan, T.J.; Gudiksen, P.H. Lawrence Livermore National Lab., CA (USA). Jul 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-891103–27: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89015626. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Measurements of airborne radioactivity over Europe, Japan, and the United States indicated that the release from the Chernobyl reactor accident in the Soviet Union on April 26, 1986 contained a wide spectrum of fission up to heights of 7 km or more within a few days after the initial explosion. This high-altitude presence of radioactivity would in part be attributable to atmospheric dynamics factors other than the thermal energy released in the initial explosion. Indications were that two types of releases had taken place – an initial powerful explosion followed by days of a less energetic reactor fire. The Atmospheric Release Advisory Capability (ARAC) at the Lawrence Livermore National Laboratory (LLNL) utilized three-dimensional atmospheric dispersion models to determine the characteristics of the source term (release) and the evolution of the spatial distributions of the airborne radioactivity as it was transported over Europe and subsequently over the northern hemisphere. This paper describes the ARAC involvement and the results of the hemispheric model calculations which graphically depict the extensive dispersal of radioactivity. 1 fig.

1438 **A simple model for discounting radiation health effects risks with time.** Sandquist, G.M.; Rogers, V.C. *Transactions*

of the American Nuclear Society (USA), 57: 75-76 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In estimating human health effects resulting from ionizing radiation exposures, it is often assumed that the age of the person at the time of exposure and the latency period for the appearance of any associated health effects are values that maximize the consequences of the exposure. Such assumptions are obviously conservative, but they can result in distortions and errors when nondiscounted radiation-related health effects arising from nonradiation-related risks. Human life expectancy obviously decreases with age, and the latency period for radiation-related health effects can range from a few years to several decades. For example, if a man is 45 yr old at the time of exposure and this exposure results in a lethal health effect 20 yr after exposure, then the expected number of years of life loss is ≈5 yr and not 70 yr, as is commonly assumed in radiation risk assessment studies. If one full-health effect is equivalent to 70 person-yr, then this example exposure results in only 0.07 full-health effects.

1439 **Uses of irradiation for inactivation of microorganisms.** Brynjolfsson, A. *Transactions of the American Nuclear Society (USA),* 57: 76 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The lethal effects of radiation on microorganisms was noted soon after the discovery of X rays in 1895. In 1904, it was shown that vegetative bacteria are more sensitive than spores; however, no industrial applications could be made as the radiation sources were too expensive. In the mid-1950s, it became economical and practical to sterilize medical products, and ever since sterilization has been a growing industry. Radiation sterilization technology has made possible users of new materials, such as plastics. Food irradiation is about to take off. Just as there was a resistance to pasteurization of milk when it was first introduced, there will be resistance to radpasteurization. Irradiated foods have been proven safe beyond reasonable doubt. Safety has been established through two independent methods: (1) through the most extensive multigeneration animal feeding studies ever carried out, and (2) by analyzing the radiolytic products formed and the chemical changes that take place when food is irradiated. The possible toxicity of these products has been evaluated by an independent group of toxicologists, who based their evaluation on the results of exposure of these products in large quantities either to humans or to animals.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 935, 1224, 1274, 1306, 1336, 1342, 1375, 1409

1440 (AD-A-205143/1/XAB) **Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988.** Eurell, T.E. Illinois Univ., Urbana, IL (USA). Dept. of Veterinary Biosciences. Dec 1988. 11p. Available from NTIS, PC A03/MF A01.

Fischer 344 male rats have a dose- and time-dependent renal proximal tubular degeneration induced by certain hydrocarbon compounds. This degeneration my be associated with a low-molecular-weight urinary protein called alpha-2U globulin. The authors using a rat-strain variation of the alpha-2U globulin molecule and metabolic alteration of the urinary pH as methods to investigate the hydrocarbon-induced nephrotoxic response. Two significant advances were made in the first year of this project: (1) a histochemical procedure was developed to specifically evaluate changes in the renal epithelial lysosome, and (2) a rat-strain difference was detected in susceptibility to hydrocarbon-induced nephrotoxicity.

1441 (DOE/ER/60524–2) **Publications resulting from research supported in whole or in part by this grant: Progress report, September 1987–August 1988.** McCormick, J.J. Michigan State Univ., East Lansing, MI (USA). 1989. 17p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract FG02-87ER60524. Order Number DE90001524. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have developed an infinite lifespan human fibroblast cell line after transfection of a v-*myc* gene into human fibroblasts. The cells have normal morphology, have doubled more than 200 times since going through crisis, are not tumorigenic, and except for their infinite lifespan, are apparently normal. These cells can be converted into malignant cells by transfection and expression of a H-, N- or K-*ras* oncogene. When *finite* lifespan human fibroblasts are transfected with the same *ras* gene constructions, the cells take on the same in vitro characteristics, but do not form tumors and they still retain the finite lifespan characteristic. Since the *ras* and *myc* oncogenes used to transfect the MSU-1.1 cells have normal proto-oncogene homologs in the human genome, it seems likely that it is these normal genes that become "activated" by carcinogen attack. We have undertaken the transfection studies to understand the role of various oncogenes in malignant transformation of human fibroblasts. With a knowledge of the phenotype caused by a specific oncogene, we can replace the transfection of a specific oncogene with carcinogen activation of the homologous gene. By proceeding in this way, we should be able to develop qualitative methods for the malignant transformation of human fibroblasts by carcinogens. 3 refs., 2 figs., 1 tab.

1442 (ORNL/M–785) **Agency for toxic substances and disease registry: Annual report for FY 1987, October 1, 1986–September 30, 1987.** Oak Ridge National Lab., TN (USA). Jun 1988. 124p. Sponsored by U.S. Department of Health and Human Services. DOE Contract AC05-84OR21400. Order Number DE90002151. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The congressional mandates under which the Agency for Toxic Substances and Disease Registry (ATSDR) operates are generally broad in scope, but very specific in intent. They concern the health effects of human exposure to hazardous substances in the environment. This report recounts the accomplishments in meeting specific mandates and indicates plans and directions for work to meet others. The report is organized by program area and covers the federal fiscal year 1987 (October 1, 1986 through September 30, 1987). Two items of importance were performed in FY 1987 by senior management at ATSDR that are not directly reportable by individual program area: first, the priorities of the agency's programs were reordered, and second, the formation of an ATSDR Board of Scientific Counselors was initiated. The reordering of priorities reflects the agency's have in met certain mandates (such as completion of the first 25 toxicological profiles) and takes cognizance of other congressionally mandated deadlines (such as performing health assessments for all National Priorities List Superfund sites). The agency is establishing a Board of Scientific Counselors to provide advice and guidance on ATSDR's programs to ensure scientific quality, timeliness, utility, and dissemination of results. Specifically, the board will advise on the adequacy of science in ATSDR-supported research, emerging problems that require scientific investigation, accuracy and currency of science in ATSDR reports, and program areas to be emphasized and/or deemphasized. The Agency for Toxic Substances and Disease Registry continued , in FY 1987, to meet its mission of preventing of mitigating adverse human health effects and diminished quality of life resulting from exposure to hazardous substances in the environment. 156 refs.

1443 (ORNL/TM–11194) **Environmental Sciences Division Toxicology Laboratory standard operating procedures.** Kszos, L.A.; Stewart, A.J.; Wicker, L.F.; Logsdon, G.M. Oak Ridge National Lab., TN (USA). Sep 1989. 75p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90001849. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3337.

This document was developed to provide the personnel working in the Environmental Sciences Division's Toxicology Laboratory with documented methods for conducting toxicity tests. The document consists of two parts. The first part includes the standard operating procedures (SOPs) that are used by the laboratory in conducting toxicity tests. The second part includes reference procedures from

the US Environmental Protection Agency document entitled Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, upon which the Toxicology Laboratory's SOPs are based. Five of the SOPs include procedures for preparing Ceriodaphnia survival and reproduction test. These SOPs include procedures for preparing Ceriodaphnia food (SOP-3), maintaining Ceriodaphnia cultures (SOP-4), conducting the toxicity test (SOP-13), analyzing the test data (SOP-13), and conducting a Ceriodaphnia reference test (SOP-15). Five additional SOPs relate specifically to the fathead minnow (Pimephales promelas) larval survival and growth test: methods for preparing fathead minnow larvae food (SOP-5), maintaining fathead minnow cultures (SOP-6), conducting the toxicity test (SOP-9), analyzing the test data (SOP-12), and conducting a fathead minnow reference test (DOP-14). The six remaining SOPs describe methods that are used with either or both tests: preparation of control/dilution water (SOP-1), washing of glassware (SOP-2), collection and handling of samples (SOP-7), preparation of samples (SOP-8), performance of chemical analyses (SOP-11), and data logging and care of technical notebooks (SOP-16).

1444 (PB–89-197727/XAB) **Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves.** Vozzo, S.F.; Miller, J.E.; Heagle, A.S.; Pursley, W.A. Agricultural Research Service, Raleigh, NC (USA). 1988. 10p. Available from NTIS, PC A02/MF A01.

Pub. in Environmental Pollution, Vol. 53, 471-473(1988).

Detailed physiological measurements were taken in controlled field experiments to better elucidate how environmental stresses interact to affect a soybean plant's physiology and growth. Nondestructive techniques were used to measure weekly and diurnal effects of ozone and water stress on net photosynthesis, stomatal resistance, and water status of field-grown soybean leaves. Open-top field chambers were used to expose soybeans to seasonal 12-h/day mean concentrations of 0.018 (CF), 0.059 (1.3NF) and 0.085 (1.9NF) ppm ozone. Soil water levels were well watered (WW) and water stressed (WS). Net carbon exchange-rate measurements (CER) were taken between 1000 and 1230h EST on center trifoliates with uniform exposure to sunlight. Average CER rates expressed as percent of CF over the growing season were 75% and 55% for WW 1.3NF, and 1.9NF and 90% and 61% for WS 1.3NF and 1.9NF, respectively. Measured mean seasonal photosynthesis rates of the WS CF treatments were 68% of those for the WW CF treatments.

1445 (PB–89-203319/XAB) **Pharmacokinetics in risk assessment: drinking water and health. Volume 8.** National Research Council, Washington, DC (USA). 1987. 497p. Available from NTIS, PC A21/MF A01.

See also Volume 4, PB–82-249244. Errata sheet inserted. Library of Congress catalog card no. 77-89284.

Contents include: risk assessment: historical perspectives; tissue dosimetry in risk assessment; modeling: an introduction; physiologically based pharmacokinetic modeling; allometry: body-size constraints in animal design; prediction of in vivo parameters of drug metabolism and distribution from in-vitro studies; dose, species, and route extrapolation; uncertainty in pharmacokinetic models using SIMUSOLV; interspecies and dose-route extrapolations; carcinogen DNA adducts as a measure of biological dose for risk analysis of carcinogenic data; resources available for simulation in toxicology; route-to-route extrapolation of dichloromethane exposure using a physiological pharmacokinetic model; sensitivity analysis in pharmacokinetic modeling; mutation accumulation: chronic cytotoxicant exposure; model for ethylene chloride and its application in risk assessment; mathematical modeling of ozone absorption in the lower respiratory tract; development of a physiologically based pharmacokinetic model for multiday inhalation of carbon tetrachloride; the delivered/administered dose relationship and its impact on formaldehyde risk estimates; pharmacokinetic simulation in risk assessment; hazard assessment: ozone; role of pharmacokinetic modeling in risk assessment; development of multispecies, multiroute pharmacokinetic models for methylene chloride and 1,1,1-trichloroethane (methyl chloroform); methotrexate: pharmacokinetics and assessment of toxicity; prospective predictions and validations in anticancer therapy; the application of pharmacokinetic data in carcinogenic risk assessment.

1446 (PB–89-207013/XAB) **Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition.** Weber, C.I.; Peltier, W.H.; Norberg-King, T.J.; Horning, W.B.; Kessler, F.A. Environmental Protection Agency, Cincinnati, OH (USA). Environmental Monitoring Systems Lab. Mar 1989. 260p. (EPA–600/4-89/001). Available from NTIS, PC A12/MF A01.

See also PB–86-158474.

This manual describes short-term (four- to seven-day) methods for estimating the chronic toxicity of effluents and receiving waters to the fathead minnow (Pimephales promelas), a cladoceran (Ceriodaphnia dubia), and a green alga (Selenastrum capricornutum). Also included are guidelines on laboratory safety, quality assurance, facilities and equipment, dilution water, effluent sampling and hoiding, data analysis, report preparation, and organism culturing and handling. Examples of the statistical analysis of test data are included with the methods. Supplementary information on statistical techniques for test design and analysis of toxicity test data is provided in the Appendices.

1447 (PB–89-212377/XAB) **Calibration and quality assurance for dioxin analysis.** Kibblewhite, M.G. Warren Spring Lab., Stevenage (UK). Sep 1987. 12p. (LR–630(CS)M). Available from NTIS, PC EE04/MF E04.

Calibration and quality-assurance guidelines for dioxin analysis are described. Procedures appropriate to sample extraction, extract clean-up, and gas chromatographic-mass spectroscopic determination are separately considered.

1448 (PB–89-215784/XAB) **Information profiles on potential occupational hazards: Nitroparaffins. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Nov 1981. 83p. (SRC-TR–81-617). Available from NTIS, PC A05/MF A01.

Profiles of information are presented for the following nitroparaffins: nitroethane, nitromethane, l-nitropropane, 2-nitropropane, tetranitromethane, and trinitromethane. Oral and inhalation toxicities and the degree of histological damage increase with increasing molecular weight of the compounds. The primary effects include histological liver damage and central nervous system depression, both atactic and narcotic changes, regardless of the route of administration or the duration of exposure. Vapor exposures also cause respiratory tract and conjunctival irritation and pulmonary edema. Symptoms of exposure in humans include headache, nausea, damage to the respiratory tract, and liver damage. Most of the exposures to nitroparaffins resulting from occupational pursuits have been to 2-nitropropane.

1449 (PB–89-215792/XAB) **Review and evaluation of recent scientific literature relevant to an occupational standard for ethylene dibromide.** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Nov 1979. 70p. Available from NTIS, PC A04/MF A01.

The report reviews and evaluates recent literature concerning hazards associated with exposure to ethylene dibromide. Workers exposed to ethylene dibromide may experience severe acute respiratory damage, central nervous-system depression, and severe vomiting on inhalation of the vapors. Skin contact can cause erythema, blistering, and ulceration. A recommended ceiling level for occupational exposures has been set by NIOSH at 1 mg/m^3. NIOSH has identified the following areas as needing future research: epidemiological surveys, liver and kidney function tests, and biological monitoring among exposed workers. It was also recommended that animal studies be conducted with regard to possible carcinogenic, mutagenic, and teratogenic effects. Other specific areas covered in the review included the results of animals studies already conducted in the areas of carcinogenicity, mutagenicity, reproductive effects, developmental effects, hepatic effects, metabolic studies, synergistic effects, general toxicity, work practices, engineering controls, sampling, and analytical methods.

1450 (PB–89-215818/XAB) **Information profiles on potential occupational hazards: Phthalates. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Mar 1982. 151p. (SRC-TR–82-520). Available from NTIS, PC A08/MF A01.

Information profiles are presented for these phthalates: butyl benzyl phthalate, diallyl phthalate, di-n-butyl phthalate, di-2-ethylhexyl phthalate, diethyl phthalate, diisodecyl phthalate, diisononyl phthalate, dimethyl phthalate, ditridecyl phthalate, diundecyl phthalate, N-dexy-N-decyl phthalate and mixed dialkyl (C7 to C11) phthalates. In general, the phthalates had a low order of acute toxicity. Histological damage to the lungs, liver, and kidneys was associated with acute oral and/or intraperitoneal exposures to some of the compounds. Others have caused slight skin and eye irritation. Repeated oral exposure to many of the esters resulted in liver and/or kidney damage. Ingestion of di-n-butyl phthalate in humans caused nausea, dizziness, photophobia, lacrimation and conjunctivitis. Patients receiving blood stored in polyvinyl chloride bags that contained residual di-2-ethylhexyl phthalate suffered a respiratory distress syndrome called shock lung. Neurological effects have been reported in workers exposed to a mixture of phthalate esters in production vapors. Epidemiological studies of di-2-ethylhexyl phthalate showed no adverse health effects.

1451 (PB–89-215826/XAB) **Information profiles on potential occupational hazards: Aminoazobenzenes. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Nov 1981. 113p. (SRC-TR–81-614). Available from NTIS, PC A06/MF A01.

Information profiles were prepared for the following aminoazobenzenes: 4-aminoazobenzene, 4-aminoazobenzene-3, 4'-disulfonic acid, 4-aminoazobenzene-3, 4'-disulfonic acid-disodium salt, 4-aminoazobenzene hydrochloride, 4'-aminoazobenzene-4-sulfonic acid, 4'-aminoazobenzene-4-sulfonic acid-sodium salt, ortho-aminoazotoluene, ortho-aminoazotoluene hydrochloride, C.I.-Disperse-Orange-3, C.I.-Disperse-Red-1, C.I.-Disperse-Red-5, C.I.-Disperse-Red-17, C.I.-Disperse-Yellow-3, chrysodine, 2,4-diaminoazobenzene, and N,N,-diethylaminoazobenze. Information suggested that these compounds were only mildly toxic following acute exposure. Organ damage was noted in the liver, kidneys, and spleen following subchronic or chronic exposure. After metabolic activation in the Ames assay, positive findings were obtained for 4-aminoazobenzene, chrysodine and ortho-animoazotoluene. Aminoazobenzenes, 4-aminoazobenzenes, chrysodine and ortho-aminoazotoluene have tested positively in carcinogenicity studies using laboratory mice. Ortho-aminoazotoluene crossed the placenta and increased tumor incidence in the F1 generation.

1452 (PB–89-215834/XAB) **Information profiles on potential occupational hazards: Inorganic azides. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Oct 1981. 58p. (SRC-TR–81-608). Available from NTIS, PC A04/MF A01.

Information is presented for these inorganic azides: barium azide, cesium azide, hydrazoic acid, lead azide, lithium azide, potassium azide, rubidium azide, silver azide, and sodium azide. The data given for each compound includes chemical structure, synonyms, chemical and physical properties, production information, uses, manufacturers and distributors, manufacturing processes, impurities and additives, occupational exposures, control technology and work practices, biological effects, ongoing studies, exposure standards, and sources of additional information. Humans who have suffered accidental exposures experienced inflammation of the mucous membranes and eye irritation. Necrosisan demyelination of nerve fibers were reported among mice and monkeys following acute intraperitoneal and subchronic intramuscular exposures, respectively. Subchronic oral exposure to rats caused histological cerebral and liver damage. Mutagenicity testing was positive for sodium azide in a variety of assays.

1453 (PB–89-215842/XAB) **Information profiles on potential occupational hazards: nitrophenols. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Apr 1981. 79p. (SRC-TR–81-536). Available from NTIS, PC A05/MF A01.

Information profiles are presented for the following nitrophenols: 2-nitrophenol, 3-nitrophenol, 4-nitrophenol, 2,4-dinitrophenol, and 2,4,6-trinitrophenol. The mononitrophenols were moderately toxic to animals, causing initial stimulation and subsequent depression of the respiratory and central nervous systems. Positive results were obtained in several mutagenicity assays for 3-nitrophenol and 4-nitrophenol. 2,4,-Dinitrophenol was far more acutely toxic than other important nitrophenol derivatives. It was able to uncouple oxidative phosphorylation by suppressing the coupling of electron flow to synthesis of adenosine triphosphatase. It caused weakness, intense thirst and sweating, increased body temperature and respiration rate, neuritis, convulsions, and the rapid onset of rigor mortis after death. It has also caused cataracts in humans when used as a weight-reducing aid. Inhalation of 2,4,6-trinitrophenol has caused considerable irritation to the eyes and to the mucous membrane of the respiratory tract. Dermal exposure has produced severe skin irritation and sensitization.

1454 (PB–89-215941/XAB) **Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975.** Jones, M. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies. 12 Mar 1976. 6p. (IWS–095.11A). Available from NTIS, PC A02/MF A01.

A walk-through survey was conducted at the Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana, on December 4, 1975, to determine if a mortality study of workers exposed to polychlorinated biphenyls at this facility would be feasible. The plant and current processes in the capacitor-making operation are described. Information is given on the medical program, personnel records, and environmental monitoring. Due to the amount of time required to search all the records and the practice of destroying old records, walk-though surveys of other facilities should be conducted.

1455 (PB–89-216022/XAB) **Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976.** Wolf, F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 11 Jun 1976. 3p. (IWS–057.13). Available from NTIS, PC A02/MF A01.

An industrial-hygiene survey was conducted at the International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales, Florida, on June 7-11, 1976 as part of the industry-wide study of the phosphate-fertilizer industry. Exposures that may occur routinely are sulfur dioxide, sulfuric acid mist, phosphoric acid mist, ammonia, and radon daughters. Additional exposures from maintenance operations or upset conditions include: vanadium pentoxide, heavy metals, uranium, fluoride, and silica. Recommendations are made to reduce exposure; these include the use of personal protective equipment and regular checks of the acid and ammonia lines.

1456 (PB–89-216030/XAB) **Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976.** Jones, M. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies. 23 Feb 1976. 9p. (IWS–095.14A). Available from NTIS, PC A02/MF A01.

See also PB–88-248802.

A walk-through survey was conducted at the Aerovox Industries, Inc., New Bedford, Massachusetts, on January 5, 1976, to determine if an industrial-hygiene and mortality study of workers exposed to polychlorinated biphenyls at this facility would be feasible. Oil-filled capacitors are manufactured at this plant. The plant, current operations, medical program, personnel records, industrial hygiene, and the safety program are described. Potential health hazards observed are exposure to polychlorinated biphenyls and trichloroethylene. It is recommended that this facility should be considered in the development of a cohort for a morality study because the facility has very complete records and has not altered its operation substantially.

1457 (PB–89-216220/XAB) **Information profiles on potential occupational hazards: Chlorophenols. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Mar 1981. 142p. (SRC-TR–81-532). Available from NTIS, PC A07/MF A01.

Information profiles are presented on the following compounds: 2-chlorophenol, 3-chlorophenol, 4-chlorophenol, 2,4-dichlorophenol, 2,5-dichlorophenol, 2,6-dichlorophenol, 2,3,6-trichlorophenol, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol. Studies indicate that, administered in acute lethal doses, the chlorophenols produce excitation and increased respiration followed by motor weakness, hypotonia, convulsions, coma, and death. All chlorophenols are well absorbed dermally, and toxic to skin and eyes. Workers exposed to 4-chlorophenol have demonstrated signs of functional disorders of the central and peripheral nervous systems and mucous membrane structure. Testing in mice has produced increased incidences of hepatocellular carcinomas, adenomas, hepatomas, and reticulum cell sarcomas.

1458 (PB–89-216535/XAB) **Toxicology and carcinogenesis studies of two pentachlorophenol technical-grade mixtures (CAS No. 87-86-5) in B6C3F1 mice (feed studies). Technical report series.** McConnell, E.E. National Toxicology Program, Research Triangle Park, NC (USA). Mar 1989. 261p. (NTP-TR–349). Available from NTIS, PC A12/MF A01.

Two-year toxicology and carcinogenicity studies were conducted by administering diets containing 100 or 200 ppm technical-grade pentachlorophenol or 100, 200 or 600 ppm Dowicide EC-7 to groups of 50 male and 50 female mice. Two groups of 35 male and 35 female mice were fed control diets. Under the conditions of the studies, there was clear evidence of carcinogenic activity for male B6C3F1 mice fed diets containing technical-grade pentachlorophenol, as shown by increased incidences of adrenal medullary and hepatocellular neoplasms. There was some evidence of carcinogenic activity for female B6C3F1 mice exposed to technical-grade pentachlorophenol, as shown by increased incidences of hemangiosarcomas and hepatocellular neoplasms. There was clear evidence of carcinogenic activity for male B6C3F1 mice exposed to pentachlorophenol, EC-7, as shown by increased incidences of adrenal medullary and hepatocellular neoplasms. There was clear evidence of carcinogenic activity for female B6C3F1 mice exposed to pentachlorophenol, EC-7, as shown by increased incidences of adrenal medullary and hepatocellular neoplasms and hemangiosarcomas.

1459 (PB–89-216618/XAB) **Information profiles on potential occupational hazards: Organic anhydrides. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Feb 1982. 130p. (SRC-TR–81-635). Available from NTIS, PC A07/MF A01.

Information profiles are presented on these organic anhydrides: acetic anhydride, butyric anhydride, citraconic anhydride, dodecenylsuccinic anhydride, isobutyric anhydride, maleic anhydride, phthalic anhydride, propionic anhydride, pyromellitic dianhydride, succinic anhydride, tetrahydrophthalic anhydride, and trimellitic anhydride. The organic anhydrides appear to be moderately toxic with median lethal dose levels for rats ranging from 697 to 2600 mg/kg. The maleic, phthalic, acetic, and trimellitic anhydrides appear to be the most acutely toxic of the group discussed. All were irritants to the skin, eyes, and respiratory tract. Injection site tumors have occurred following administration of succinic and maleic anhydrides. Limited evidence suggests teratogenic potentials for acetic, maleic, phthalic, and succinic anhydrides.

1460 (PB–89-216642/XAB) **Information profiles on potential occupational hazards: Inorganic chromium compounds. Draft report (Second).** Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment. Feb 1982. 128p. (SRC-TR–82-505). Available from NTIS, PC A07/MF A01.

Information profiles are presented for the following inorganic chromium compounds: chromic(VI) acid, chromic(III) hydroxide, chromic(III) oxide, chromic(III) sulfate, chromic(III) sulfate (basic), chromium dioxide, potassium dichromate(VI), lead chromate, sodium-chromate(VI), sodium-dichromate(VI), and zinc-yellow-chromate(VI). Biological effects of hexavalent chromium in humans included skin ulceration, dermatitis, nasal membrane irritation and ulceration, nasal septal perforation, rhinitis, nosebleed, nephritis, liver damage, epigastric pain, pulmonary congestion and edema, and erosion and discoloration of teeth. Chromium(VI) compounds caused mutations in a variety of systems. Exposure to trivalent chromium in the work place has caused contact dermatitis and chrome ulcers. Epidemiological studies indicated respiratory carcinogenicity among workers occupationally exposed during chromate production.

1461 (PB–89-217749/XAB) **Responses of susceptible subpopulations to nitrogen dioxide. Research report, June 1983-January 1988.** Morrow, P.E.; Utell, M.J. Rochester Univ., NY (USA). School of Medicine and Dentistry. Feb 1989. 61p. Available from NTIS, PC A04/MF A01.

Symptom responses and changes in pulmonary function were investigated in people with asthma or chronic obstructive pulmonary disease (COPD) exposed to 0.3 ppm nitrogen dioxide (NO_2) for four hours. Nonrespiratory-impaired (normal) subjects of comparable ages constituted the control groups. All exposures included periods of exercise and pulmonary function measurements. No significant symptomatic or physiological responses to NO_2 could be detected in either the young or elderly control group. The asthmatic group did not manifest significant reductions in lung function after exposure to 0.3 ppm NO_2, compared to their preexposure baseline data or to their responses after a comparable four-hour exposure to air. During light exercise, subjects with COPD were progressively responsive to 0.3 ppm NO_2. Subgroup analyses within the asthmatic, COPD, and elderly normal subject groups and intergroup comparisons yielded significant findings and associations.

1462 (PB–89-220602/XAB) **Workshop report on EPA (Environmental Protection Agency) guidelines for carcinogen risk assessment. Held in Virginia Beach, Virginia on January 11-13, 1989.** Farland, W.H.; Hill, R. Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment. Mar 1989. 109p. (EPA–625/3-89/015). Available from NTIS, PC A06/MF A01.

On September 24, 1986, the U.S. Environmental Protection Agency (EPA) issued guidelines for assessing human risk from exposure to environmental carcinogens. Since that time, new information in several areas of carcinogen risk assessment has led to continued EPA review and assessment of the guidelines. As part of the review, on January 11-13, 1989, EPA conducted a workshop at which experts in carcinogen risk assessment examined the scientific foundation for two aspects of the guidelines. Some workshop participants studied qualitative issues bearing on the classification of chemicals as potential human carcinogens; others focused on quantitative questions regarding extrapolation from test animal data to human populations. The workshop report highlights the major scientific issues discussed at the meeting. The report includes remarks by opening session speakers, EPA's pre-meeting statement of issues, summary statements for major workshop discussions, reference lists and a list of workshop, rather than standard scientific papers.

1463 (PB–89-868020/XAB) **Toxicity of zinc. July 1985-July 1989 (Citations from the NTIS database). Report for July 1985-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 79p. Available from NTISPC N01/MF N01.

Supersedes PB–88-850482.

This bibliography contains citations concerning health effects related to the uptake and toxicity of zinc. The emissions of trace elements of zinc in the atmosphere, the sources of these emissions, monitoring techniques, and accumulation in the environment are considered. (This updated bibliography contains 107 citations, 43 of which are new entries to the previous edition.)

1464 Nucleoside adducts are formed by cooperative reaction of acetaldehyde and alcohols: Possible mechanism for the role of ethanol in carcinogenesis. Fraenkel-Conrat, H. (Lawrence Berkeley Lab., CA (USA)); Singer, B. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(11): 3758-3761 (Jun 1988). DOE Contract AC03-76SF00098.

The exocyclic amino groups of ribonucleosides and deoxyribonucleosides react rapidly at ambient temperature with acetaldehyde and alcohols to yield mixed acetals [-NH-CH(CH_3)OR]. Nucleotides and nucleoside di- and triphosphates also react. Depending on the nucleoside used and on the relative amounts of aldehyde, alcohol, and water, preparative reactions reach equilibrium with yields up to 75% in a few house. The structures have been confirmed by fast atom bombardment MS and proton NMR. Half-lives at 37°C have

been determined, and maximum stability is in the pH range of 7.5-9.5. In the absence of alcohol, acetaldehyde-nucleoside adducts could be isolated at 4°C, but these were too unstable to characterize except for their UV spectra, also at 4°C. Ethanol is often present in human blood and tissues, and acetaldehyde is its initial metabolic product, as well as being formed by many other metabolic processes. Both chemicals have separately been implicated in carcinogenic and other cytophathologic processes, but no cooperative mechanism has been proposed. The reactions reported here are of biological concern because they also occur in dilute aqueous solution. These finding supply a mechanism by which ethanol can be covalently bound to nucleic acids under physiological conditions.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 37, 309

1465 (PB–89-920900/XAB) **FDA (Food and Drug Administration) Compliance Program Guidance Manual. Section 4. Medical and radiological devices. Irregular report.** Food and Drug Administration, Washington, DC (USA). 1989. o Available from NTISSubscription.

Supersedes PB–88-920900. Paper copy available on subscription, North American Continent price $140.00/year; all others write for quote. Updates also available in single copies. Basic manual available individually as PB–89-920999.

The FDA Compliance Program Guidance Manual provides a system for issuing and filing program plans and instructions directed to Food and Drug Administration Field operations for project implementation. Section IV provides those chapters of the Compliance Program Guidance Manual which pertain to the areas of medical and radiological devices. Some of the areas of coverage include laser and sunlamp standards inspections, compliance testing of various radiation-emitting products such as television receivers and microwave ovens, emergency response planning and policy, premarket approval and device manufacturers inspections, device problem reporting, sterilization of devices, and consumer education programs on medical and radiological devices.

57 HEALTH AND SAFETY

Refer also to citation(s) 37, 303, 616, 1261

1466 (CONF-8908108–3) **A comparative study of six data sources' ability for estimating interstate motor carrier VMT [vehicle miles of travel].** Hu, P.S.; Wright, T.; Miaou, Shaw-Pin. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research; Federal Highway Administration. DOE Contract AC05-84OR21400. From American Statistical Association meeting; Washington, DC (USA); 9 Aug 1989. Order Number DE90001644. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several Federal Government agencies require estimates of vehicle miles of travel (VMT) by interstate commercial trucks. These estimates are essential in determining accident exposure and accident rates for these trucks, and in determining highway investment needs and the allocation of highway costs. VMT estimates are currently based on various nationwide transportation surveys and/or data sources using various estimation procedures do not provide consistent estimates. A summary of evaluation results of these data sources and estimation procedures is presented in this paper. 4 refs., 1 tab.

58 GEOSCIENCES

1467 (GSCAN-P–85-1B) **Current research.** Geological Survey of Canada, Ottawa, ON (Canada). 1985. 637p. Order Number DE88780080. Available from NTIS (US Sales Only), PC A99/MF A01.

Individual papers in scope are processed for the data base. (DLC)

5801 Geology and Hydrology

Refer also to citation(s) 161, 162, 179, 1238, 1260

1468 (CONF-8810116–Summ.) **Mobility of colloidal particles in the subsurface: Chemistry and hydrology of colloid-aquifer interactions: International series of interactive seminars summary report.** McCarthy, J.F. Oak Ridge National Lab., TN (USA). 1988. 111p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Seminar on mobility of colloidal particles in the subsurface: chemistry and hydrology of colloid-aquifer interactions; Manteo, NC (USA); 4-6 Oct 1988. Order Number DE90000724. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3352.

A meeting on "Mobility of Colloidal Particles in the Subsurface: Chemistry and Hydrology of Colloid-Aquifer Interactions" was held on October 4–6, 1989, in Manteo, North Carolina. The purpose of the meeting was to examine the chemical and hydrologic factors controlling the transport and deposition of organic and inorganic colloidal particles in subsurface environments. Sessions dealt with technical difficulties in sampling and characterizing colloidal particles in groundwater, and with observations of colloid movement in laboratory and field systems, with an emphasis on the chemical and hydrological factors controlling transport. Discussion sessions attempted to summarize the consensus of the group on two important issues: (1) identifying natural conditions that promote either the transport or the deposition of colloids, with the intent of focusing attention on those subsurface environments with the greatest probability for the occurrence of mobile colloids, and (2)exploring strategies to manipulate colloid mobilization and deposition within subsurface systems to aid in remediation or mitigation of contamination at hazardous waste sites.

1469 (INIS-BR–1628) **Age of the rocks and the metamorphic episodes from the Southeastern of Sao Paulo state.** Tassinari, C.C.G.; Kawashita, K.; Schmuss, R. van; Taylor, P.N. Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil). 1988. 16p. (In Portuguese). (CONF-8811277–: 35. Brazilian Congress of Geology, Belem (Brazil), 6-13 Nov 1988). Order Number DE90606124. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Rb-Sr, Pb-Pb and U-Pb geochronologic studies carried out on precambrian rocks from the southeastern Sao Paulo state suggest a Complex geologic evolution during the Archean and Proterozoic times. This region is divided in five differents allochthonous terranes named Itapira-Amparo, Piracaiba-Jundiai, Sao Roque, Embu and Costeiro, separated by thrust and strike-slip faults. The Itapira-Amparo domain has a original history dating back to 3.4 Ga. and since 2.6 to 2.5 Ga. and 2.2 to 1.9 Ga. metamorphic rockformation episode occurred involving both mantle-derived magmas and recycled material. Supracrustal sequences developed around 1.4 Ga. The domain was locally reworked in 0.8 - 0.65 Ga. In the Piracaia-Jundiai the main rock-formation event occurred at 1.4 Ga., but this domian was affected by strong granization and migmatization episodes during the period 1.1 - 0.6 Ga. The third terrain is characterized by the Sao Roque metavolcanossedimentary sequence developed during the time period 1.8 - 0.7 Ga., and comprising two metamorphic superimposed events (1.4 and 0.8 - 0.7 Ga.). the post-tectonics granites ranging in ages from 0.7 to 0.55 Ga. Within the Embu terrain ages of 2.5, 1.4 and 0,75 Ga. were obtained for the metamorphic terrain, with post-tectonic activities around 650 Ma. In the Costeiro domain all the metamorphic rocks developed in late-Proterozoic time, with syntectonic phase around 650 Ma.

1470 (INIS-BR–1629) **K-Ar geochronology of mafic dyke swarms from the meridional part of Sao Francisco craton and implications on tectonic context.** Teixeira, W.; Kawashita, K.; Pecchio, M.; Tame, N.R. Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil). 1988. 18p. (In Portuguese). (CONF-8811277–: 35. Brazilian Congress of Geology, Belem (Brazil), 6-13 Nov 1988). Order Number DE90606125. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The southern region of Sao Francisco Craton is made up of gneissic-granitoid terranes (mainly of amphibolite facies) associated with supracrustals, which can be separated into two crustal provinces, formed during the Archean (3-2-2.6 Ga.) and during the

Early Proterozoic (2.4-2.0 Ga.). Mafic dyke swarms inject the basement complexes west of Belo Horizonte city, but not the Late proterozoic Bambui sedimentary cover. These dykes show NNW, NW, WNW, NNE and ENE trends and are anorogenic. Most dykes are tholeiitic in composition. Metamorphic recrystallization at greenschist to amphibolite facies as well as minor hydrothermal and/or deuteric transformations are characteristics in most of these dykes. About sixty K/Ar determinations have been performed on plagioclases, amphiboles and whole rocks. They are interpreted using K/Ar diagrams and histogram, and according to the crustal evolution proposed for the craton. The available radiometric data suggest that the main period of mafic intrusions took place in the Early proterozoic as supported by the apparent ages on amphiboles. However, the beginning of the Middle Proterozoic (1.7-1.5 Ga.) probably corresponds to a period of tensional tectonics as well. On the other hand, most ages obtained on plagioclases and whole rocks, can be associated with Late Proterozoic processes of argon gain or loss. The results are tectonicaly associated with crustal rifting of the continental mass. This two radiometric groupings are characteristic for the evolution of the Early proterozoic crustal provine and of the Mid-Proterozoic intracratonic Espinhaco System respectively. The youngest Late Proterozoic apparent ages associated with the reflections of the contemporaneous evolution of the Braziliano marginal mobile belt which is also suggested by the partial resetting of the K/Ar ages of basement rocks within the eastern part of the Sao Francisco Craton. (author)

1471 (INIS-BR–1630) **Geochronological data for lithostratigraphic complexes of a crystalline basement from the South regions of Minas Gerais and adjacent areas of the Sao Paulo state.** Kawashita, K.; Artur, A.C.; Wernick, E. Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil). 1988. 16p. (In Portuguese). (CONF-8811277–: 35. Brazilian Congress of Geology, Belem (Brazil), 6-13 Nov 1988). Order Number DE90606126. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

New geochronological data (Rb/Sr, Pb/Pb) for the Amparo and Pinhal Complexes, southern State of Minas Gerais and adjacent areas of the State of Sao Paulo are discussed with respect to other lithostratigraphic complexes there. Among the different complexes considered, 4 are composed mainly by rock belonging to typical infrastructure associations: Barcelona, Guaxupe, Amparo and Pinhal complexes. The Barbacena Complex is a typical gray gneiss complex and geochronological data by different methods confirm its Archean age. The Guaxupe Complex is composed mainly by different types of charnockitic rocks and an Archean age is assumed on geotectonic basis due to its neighboring association with the gray gneiss/greenstone belt, a though confirming geochronological data are still missing, a normal feature in this type of mobile belts which generally show a complex, polycyling evolution. Geochronological data by different methods on diverse rock types indicates that the Amparo and Pinhal complexes are respectively of Lower an Upper proterozoic age. Geochronological, geological and petrographic data reveal that both complexes are composed mainly by 3 basic rock associations: a-mainly derived magmatic rocks including mafic/ultramafic ones as well as calc-alkaline, subalcaline and even alkaline granitoids; b-orthogneisses, migmatites and crustal granites derived by metamorphic processes acting on older, pre-existing rocks; corthogneisses and migmatites resulting from metamorphic processes acting on magmatic rocks intruded during the same tecto-metamorphic cycle during which its transformation took place. The results suggest a polycyclic evolution by successive tecto-metamorphic events which affected the older rocks of the considered are either by the reworking of enclosing rocks around pericratonic continental main magmatic arcs or by the remobilisation of older basement rocks during continental collisions. (author).

1472 (INIS-BR–1637) **Lead-lead dating of migmatitic rocks from the region of the Sao Jose dos Campos, Sao Paulo state, Brazil.** Babinski, M.; Iyer, S.S.; Kawashita, K. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 2p. Order Number DE90606120. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. ISOTOPE DATING/lead; ROCKS/isotope dating; LEAD; ROCKS; RUBIDIUM; STRONTIUM 86; STRONTIUM 87; BRAZIL

1473 (N–89-21287) **Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.** Lunar and Planetary Inst., Houston, TX (USA). 1988. 238p. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). Available from NTIS, PC A11/MF A01.

Topics addressed include: Cretaceous-Tertiary mass extinctions; geologial indicators for meteorite collisions; carbon dioxide catastrophes; volcanism; climatic changes; geochemistry; mineralogy; fossil records; biospheric traumas; stratigraphy; mathematical models; and ocean dynamics.

1474 (N–89-21287, pp. 1) **Debate over the Cretaceous-Tertiary boundary.** Alvarez, W.; Asaro, F.; Alvarez, L.W.; Michel, H.V. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Large-body impact on the Earth is a rare but indisputable geologic process. The impact rate is approximately known from objects discovered in Earth-crossing orbits and from the statistics of craters on the Earth's surface. Tektite and microtektite strewn fields constitute unmistakable ejecta deposits that can be due only to large-body impacts. The Cretaceous-Tertiary (K-T) boundary coincides with an unusually severe biological trauma, and this stratigraphic horizon is marked on a worldwide basis by anomalous concentrations of noble metals in chondritic proportions, mineral spherules with relict quench-crystallization textures, and mineral and rock grains showing shock deformation. These features are precisely compatible with an impact origin. Although only impact explains all the types of K-T boundary evidence, the story may not be as simple as once thought. The original hypothesis envisioned one large impact, triggering one great extinction. Newer evidence hints at various complications. Different challenges are faced by the occupants of each apex of a three-cornered argument over the K-T event. Proponents of a non-impact explanation must show that the evidence fits their preferred model better than it fits the impact scenario. Proponents of the single impact-single extinction view must explain away the complications. Proponents of a more complex impact crisis must develop a reasonable scenario which honors the new evidence.

1475 (N–89-21287, pp. 6-7) **Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions.** Asaro, F.; Alvarez, W.; Michel, H.V.; Alvarez, L.W.; Anders, M.H.; Montanari, A.; Kennett, J.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

In a study of one million years of Middle Miocene sediment deposition in ODP Hole 689B in the Weddell Sea near Antarctica, a single iridium (Ir) anomaly of 44 (+ or - 10) x 10 to the 12th gram Ir per gram rock (ppt) was observed in core 6H, section 3, 50 to 60 cm, after background contributions associated with manganese precipitates and clay are subtracted. The ODP Hole 689B is 10,000 km away from another site, DSDP Hole 588B in the Tasman Sea north of New Zealand, where a single Ir anomaly of 144 + or - 7 ppt over a background of 11 ppt was found in an earlier study of 3 million years of deposition. From chemical measurements the latter deposition was thought to be impact-related. Ir measurements were made, following neutron activation, with the Iridium Coincidence Spectrometer. The age vs depth calibration curves given in the DSDP and ODP preliminary reports indicate the ages of the Iranomalies are identical, 11.7 million years, but the absolute and relative uncertainties in the curves are not known. Based on the newest age data the age estimate is 10 million years. As the Ir was deposited at the two sites at about the same time and they are one quarter of the way around the world from each other it seems likely that the deposition was world-wide. The impact of a large asteroid or comet could produce the wide distribution, and this data is supportive of the impact relationship deduced for Deep Sea Drilling Project (DSDP) 588B

from the chemical evidence. If the surface densities of Ir at the two sites are representative of the world-wide average, the diameter of a CI type asteroid containing the necessary Ir would be 3 + or - 1 km, which is large enough to cause world-wide darkness and hence extinctions although the latter point is disputed.

1476 (N–89-21287, pp. 13-14) **Late Wenlock (middle Silurian) bio-events: Caused by volatile boloid impact/s.** Berry, W. B. N.; Wilde, P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Late Wenlockian (late mid-Silurian) life is characterized by three significant changes or bioevents: sudden development of massive carbonate reefs after a long interval of limited reef growth; sudden mass mortality among colonial zooplankton, graptolites; and origination of land plants with vascular tissue (Cooksonia). Both marine bioevents are short in duration and occur essentially simultaneously at the end of the Wenlock without any recorded major climatic change from the general global warm climate. These three disparate biologic events may be linked to sudden environmental change that could have resulted from sudden infusion of a massive amount of ammonia into the tropical ocean. Impact of a boloid or swarm of extraterrestrial bodies containing substantial quantities of a volatile (ammonia) component could provide such an infusion. Major carbonate precipitation (formation), as seen in the reefs as well as, to a more limited extent, in certain brachiopods, would be favored by increased pH resulting from addition of a massive quantity of ammonia into the upper ocean. Because of the buffer capacity of the ocean and dilution effects, the pH would have returned soon to equilibrium. Major proliferation of massive reefs ceased at the same time. Addition of ammonia as fertilizer to terrestrial environments in the tropics would have created optimum environmental conditions for development of land plants with vascular, nutrient-conductive tissue. Fertilization of terrestrial environments thus seemingly preceded development of vascular tissue by a short time interval. Although no direct evidence of impact of a volatile boloid may be found, the bioevent evidence is suggestive that such an impact in the oceans could have taken place. Indeed, in the case of an ammonia boloid, evidence, such as that of the Late Wenlockian bioevents may be the only available data for impact of such a boloid.

1477 (N–89-21287, pp. 17-18) **Shocked quartz and more: Impact signatures in K-T boundary clays and claystones.** Bohor, B.F. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Quartz grains displaying multiple sets of planar features are described from numerous Cretaceous-Tertiary (K-T) boundary clays and claystones at both marine and nonmarine depositional sites around the world. All these sites also show anomalously high amounts of iridium and enrichments of other siderophile elements in cosmic ratios within these boundary units. This combination of mineralogical and geochemical features are used in support of an impact hypothesis for the end-Cretaceous event. Recently, it was suggested that some combination of explosive and nonexplosive volcanism associated with the formation of the Deccan traps in India could be responsible for the mineralogy and geochemistry seen in the K-T boundary units. Besides the obvious contradition of simultaneous explosive and nonexplosive volcanism from one locality during an instant of geologic time, there remains the difficulty of spreading both iridium (and trace elements in cosmic proportions) and quartz grains around the world by volcanic (atmospheric) transport. In addition, the ability of volcanism to produce the type of shock metamorphism seen in minerals at the K-T boundary was not demonstrated. Multiple sets of shock lamellae in quartz are considered characteristic of shock metamorphism in rocks at the sites of known impact craters and are the type of deformation seen in quartz from K-T boundary clays and claystones. Single sets of poorly defined lamellae described from rare quartz grains in certain volcanic deposits are characteristic of tectonic deformation and do not correspond to the shock lamellae in quartz from K-T sediments and impact structures. So-called shock mosaicism in quartz and feldspar grains described from volcanic deposits can result from many processes other than shock metamorphism, and therefore is not considered to be an effect characteristic solely of shock.

1478 (N–89-21287, pp. 40-41) **Extended Cretaceous-Tertiary (K/T) stable isotope record. Implications for paleoclimate and the nature of the K/T boundary event.** Dhondt, S. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

In order to obtain a detailed single site record of marine productivity and temperature across the Cretaceous-Tertiary (K/T) boundary, both delta C-13 and delta O-18 values were measured in paired surface and deep water microfossil and nannofossil samples of mid-latitude South Atlantic Deep Sea Drilling Project (DSDP) Site 528. Additionally, the percent sedimentary carbonate content of the rock samples from which the analyzed fossil samples were taken, were determined. The analyzed interval spanned the last approximately 1 million years of the Cretaceous (the Abathomphalus mayaroensis foraminiferal zone) and the first approximately 9 million years of the Tertiary (the Paleocene). Paired samples were analyzed every 150 cm of the entire 165 m sampled interval (1 sample per recovered DSDP section), every 20 cm for 2.0 m below and 2.5 m above the K/T boundary, and every 0.25 cm immediately below, at, and above the K/T boundary clay. The Cretaceous-Tertiary boundary and earliest Paleocene record of DSDP Site 528 is marked by at least two strong decreases in the surface-to-deep delta C-13 gradient (one at the K/T boundary (66.4 mybp1) and one approximately 150,000 to 200,000 years later). Both of these decreases co-occur with radical decreases in percent carbonate content and appear to indicate not one, but two, strong decreases in marine primary productivity during the analyzed interval.

1479 (N–89-21287, pp. 44-45) **Proterozoic Bushveld-Vredefort catastrophe: Possible causes and consequences.** Elston, W.E.; Twist, D. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Bushveld Complex and Vredefort Dome are unique features, formed in close proximity during the same time interval, approximately 2 Ga. Both show evidence of catastrophic events in the shallow marine environment of the otherwise stable Kaapvaal Craton. Explanation by multiple impacts of an asteroid, brecciated by an inter-asteroidal collision and disintegrating in Earth's gravity field is supported by pseudotachylite, shatter cones, coesite, and stishovite at Vredefort but these shock phenomena were not found in the Bushveld Complex. The Bushveld Complex was formerly interpreted as a lopolith, a view incompatible with gravity, electrical resistivity, magnetic, and seismic-reflection data. It is outlined by five inward-dipping lobes of layered ultramafic-mafic plutonic rocks that partly coalesce to form a basin-like feature 400 km in diameter and 65,000 sq. km. in area, equivalent to a small lunar mare. The Bushveld Complex is orders of magnitudes larger than other proposed terrestrial impact structures and differs from them in important ways. Its principal members, in order of age, are Rooiberg Felsite, RLS, and Lebowa Granite. The Bushveld-Vredefort events occurred during the interval from neutral or reducing atmosphere to oxidizing atmosphere. This transition is usually related to the evolution of photosynthesizing organisms. If the impact hypothesis for Bushveld-Vredefort can be confirmed, it may represent a global catastrophe sufficient to contribute to environmental changes favoring aerobic photosynthesizing eukaryotes over anaerobic prokaryotes.

1480 (N–89-21287, pp. 56-57) **Evidence for a single impact at the Cretaceous-Tertiary boundary from trace elements.** Gilmour, I.; Anders, E. Lunar and Planetary Inst., Houston, TX

(USA). 1988. (NASA-CR-183329;NAS-1.26:183329;LPI-CONTRIB-673;CONF-8810341--: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Not only meteoritic elements (Ir, Ni, Au, Pt metals), but also some patently non-meteoritic elements (As, Sb) are enriched at the K-T boundary. Eight enriched elements at 7 K-T sites were compared and it was found that: All have fairly constant proportions to Ir and Kilauea (invoked as an example of a volcanic source of Ir by opponents of the impact theory) has too little of 7 of these 8 elements to account for the boundary enrichments. The distribution of trace elements at the K-T boundary was reexamined using data from 11 sites for which comprehensive are available. The meteoritic component can be assessed by first normalizing the data to Ir, the most obviously extraterrestrial element, and then to CI chondrites. The double normalization reduces the concentration range from 11 decades to 5 and also facilitates the identification of meteoritic elements. At sites where trace elements were analyzed in sub-divided samples of boundary clay, namely, Caravaca (SP), Stevns Klint (DK), Flaxbourne River (NZ) and Woodside Creek (NZ), Sb, As and Zn are well correlated with Ir across the boundary implying a common deposition mechanism. Elemental carbon is also enriched by up to 10,000 x in boundary clay from 5 K-T sides and is correlated with Ir across the boundary at Woodside Creek. While biomass would appear to be the primary fuel source for this carbon a contribution from a fossil fuel source may be necessary in order to account for the observed C abundance.

1481 (N-89-21287, pp. 58-59) **Nitrogen geochemistry of a Cretaceous-Tertiary boundary site in New Zealand.** Gilmour, I.; Boyd, S.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR-183329;NAS-1.26:183329;LPI-CONTRIB-673;CONF-8810341--: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Nitrogen in the basal layer of the K-T boundary clay at Woodside Creek, New Zealand, has an abundance of 1100 ppm, a 20-fold enrichment over Cretaceous and Tertiary values. The enrichment parallels that for Ir and elemental carbon (soot); all decrease over the next 6 mm of the boundary clay. The C/N ratio, assuming the nitrogen to be associated with organic rather than elemental carbon, is approximately 5 for the basal layer compared to 20 to 30 for the remainder of the boundary clay. The correlation between N and Ir abundances appears to persist above the boundary, implying that the N is intimately associated with the primary fallout and remained with it during the secondary redeposition processes that kept the Ir abundance relatively high into the lowermost Tertiary. Apparently the basal layer of the boundary clay represents the accumulation of a substantial quantity of N with an isotopic composition approximately 10 percent heavier than background delta value of N-15 values. If the boundary clay represents an altered impact glass from a meteorite impact than it probably denotes a time period of less than 1 year. Therefore, the changes in nitrogen geochemistry apparently occurred over a very short period of time. The high abundance of N and the correspondingly low C/N ratio may reflect enhanced preservation of organic material as a result of the rapid sweepout and burial of plankton by impact ejecta, with little or no bacterial degradation. It is conceivable that the shift in delta value of N-15 may represent an influx of nitrogen from a different source deposited contemporaneously with the impact ejecta. An interesting possibility is that it may be derived from nitrate, produced from the combustion of atmospheric nitrogen.

1482 (N-89-21287, pp. 60-62) **Global Cretaceous-Tertiary fire: Biomass or fossil carbon.** Gilmour, I.; Guenther, F. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR-183329;NAS-1.26:183329;LPI-CONTRIB-673;CONF-8810341--: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The global soot layer at the K-T boundary indicates a major fire triggered by meteorite impact. However, it is not clear whether the principal fuel was biomass or fossil carbon. Forests are favored by delta value of C-13, which is close to the average for trees, but the total amount of elemental C is approximately 10 percent of the present living carbon, and thus requires very efficient conversion to soot. The PAH was analyzed at Woodside Creek, in the hope of finding a diagnostic molecular marker. A promising candidate is 1-methyl-7-isopropyl phenanthrene (retene,), which is probably derived by low temperature degradation of abietic acid. Unlike other PAH that form by pyrosynthesis at higher temperatures, retene has retained the characteristic side chains of its parent molecule. A total of 11 PAH compounds were identified in the boundary clay. Retene is present in substantial abundance. The identification was confirmed by analysis of a retene standard. Retene is characteristic of the combustion of resinous higher plants. Its formation depends on both temperature and oxygen access, and is apparently highest in oxygen-poor fires. Such fires would also produce soot more efficiently which may explain the high soot abundance. The relatively high level of coronene is not typical of a wood combustion source, however, though it can be produced during high temperature pyrolysis of methane, and presumably other H, C-containing materials. This would require large, hot, low O2 zones, which may occur only in very large fires. The presence of retene indicates that biomass was a significant fuel source for the soot at the Cretaceous-Tertiary boundary. The total amount of elemental C produced requires a greater than 3 percent soot yield, which is higher than typically observed for wildfires. However, retene and presumably coronene imply limited access of O2 and hence high soot yield.

1483 (N-89-21287, pp. 63-64) **Late Eocene impact events recorded in deep-sea sediments.** Glass, B.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR-183329;NAS-1.26:183329;LPI-CONTRIB-673;CONF-8810341--: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Raup and Sepkoski proposed that mass extinctions have occurred every 26 Myr during the last 250 Myr. In order to explain this 26 Myr periodicity, it was proposed that the mass extinctions were caused by periodic increases in cometary impacts. One method to test this hypothesis is to determine if there were periodic increases in impact events (based on crater ages) that correlate with mass extinctions. A way to test the hypothesis that mass extinctions were caused by periodic increases in impact cratering is to look for evidence of impact events in deep-sea deposits. This method allows direct observation of the temporal relationship between impact events and extinctions as recorded in the sedimentary record. There is evidence in the deep-sea record for two (possibly three) impact events in the late Eocene. The younger event, represented by the North American microtektite layer, is not associated with an Ir anomaly. The older event, defined by the cpx spherule layer, is associated with an Ir anomaly. However, neither of the two impact events recorded in late Eocene deposits appears to be associated with an unusual number of extinctions. Thus there is little evidence in the deep-sea record for an impact-related mass extinction in the late Eocene.

1484 (N-89-21287, pp. 65) **Mineralogy and phase-chemistry of the Cretaceous/Tertiary section in the Lattengebirge, Bavarian Alps.** Graup, G. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR-183329;NAS-1.26:183329;LPI-CONTRIB-673;CONF-8810341--: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Lattengebirge K/T section reveals three distinct Ir spikes. Two of them are contained in the K/T transition zone sensu-strictu termed clayey interval, with 4.4 ppb Ir at the actual K/T boundary, and 2.8 ppb Ir 10 cm above the boundary. The highest Ir enrichment of 9 ppb, however, was detected in semi-cleaned organic material from a thin sandstone layer of Upper Maastrichtian age at 16 cm below the boundary. In this layer various discernible phases are preserved, contrasting with the worldwide observed K/T transition zones which are generally entirely composed of diagenetically altered materials. Given that, important clues to understanding the Cretaceous terminal events may be provided. The phases of the

Cretaceous Ir bearing layer at Lattengebirge consist of: sandstone fragmental minerals in a carbonate matrix, coal which is partly burnt, melt glasses presumably of combustion-metamorphic origin, and sulfides, mainly chalcopyrite, contained in the coal. Like many known K/T sections and the Lattengebirge boundary sensu-strictu, the Cretaceous horizon is enriched in Ir and chalcophile elements as well. Although the Lattengebirge section offers the freshest materials, including melt glasses, of all K/T localities investigated, no unequivocal evidence of formation by impact has been found there.

1485 (N–89-21287, pp. 66-67) **End-triassic mass extinction event.** Hallam, A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The end-Triassic is the least studied of the five major episodes of mass extinction recognized in the Phanerozoic, and the Triassic-Jurassic boundary is not precisely defined in most parts of the world, with a paucity of good marine sections and an insufficiency of biostratigraphically valuable fossils. Despite these limitations it is clear that there was a significant episode of mass extinction, affecting many groups, in the Late Norian and the existing facts are consistent with it having taken place at the very end of the period. The best record globally comes from marine strata. There was an almost complete turnover of ammonites across the T-J boundary, with perhaps no more than one genus surviving. About half the bivalve genera and most of the species went extinct, as did many archaeogastropods. Many Paleozoic-dominant brachiopods also disappeared, as did the last of the conodonts. There was a major collapse and disappearance of the Alpine calcareous sponge. Among terrestrial biota, a significant extinction event involving tetrapods was recognized. With regard to possible environmental events that may be postulated to account for the extinctions, there is no evidence of any significant global change of climate at this time. The existence of the large Manicouagan crater in Quebec, dated as about late or end-Triassic, has led to the suggestion that an impact event might be implicated, but so far despite intensive search no unequivocal iridium anomaly or shocked quartz was discovered. On the other hand there is strong evidence for significant marine regression in many parts of the world. It is proposed therefore that the likeliest cause of the marine extinctions is severe reduction in habitat area caused either by regression of epicontinental seas, subsequent widespread anoxia during the succeeding transgression, or a combination of the two.

1486 (N–89-21287, pp. 70-71) **Manson impact structure, a possible site for a Cretaceous-Tertiary (K-T) boundary impact.** Hartung, J.B. (Geological Survey, Iowa City, IA (USA)); Kunk, M.J.; Anderson, R.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Manson impact structure, about 35 km in diameter, is the largest impact crater recognized in the United States. Its center is located near the town of Manson, 29 km west of Fort Dodge, Iowa. The structure is not well known geologically because it is covered by tens of meters of glacial deposits. What is known about the structure was learned mostly from the study of water well cuttings. At Manson the normal Phanerozoic and Proterozoic sedimentary rocks were replaced by centrally uplifted Proterozoic crystalline rocks that are representative of the normal basement: This central uplift is surrounded by completely disrupted rocks which are roughly encircled by peripherally faulted and slumped sequences of normal sedimentary strata. Radially outward normal sedimentary strata are uplifted slightly. Manson, once interpreted as a cryptovolcanic structure, is now considered an impact structure based on its circular shape, its central uplift and the presence of multiple intersecting sets of shock lamellae in quartz grains from the central uplift. The Ar-40/Ar-39 age spectrum dating results for a microcline separate from the Manson 2-A core in the central uplift is shown. This spectrum is interpreted to indicate a nearly complete degassing of the microcline at the time of the Manson impact. The remainder of the gas released climbs in age with increasing temperature of release. This pattern of the age spectrum is interpreted to represent diffusional loss due to reheating at the time of the impact and during subsequent cooling. Shocked quartz grains, present in the iridium-bearing layer at the K-T boundary throughout the world, have a significantly larger size and are more abundant in the western interior of North America than elsewhere in the world. Furthermore, shocked feldspar and granitic fragments are found at the K-T boundary in North America.

1487 (N–89-21287, pp. 72-73) **How many upper Eocene microspherule layers: More than we thought.** Hazel, J.E. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The scientific controversy over the origin of upper Eocene tektites, microtektites and other microspherules cannot be logically resolved until it is determined just how many events are involved. The microspherule-bearing beds in marine sediments have been dated using standard biozonal techniques. Although a powerful stratigraphic tool, zonal biostratigraph has its limitations. One is that if an event, such as a microspherule occurrence, is observed to occur in a zone at one locality and then a similar event observed in the same zone at another locality, it still may be unwarranted to conclude that these events exactly correlate. To be in a zone a sample only need be between the fossil events that define the zone boundaries. It is often very difficult to accurately determine where within a zone one might be. Further, the zone defining events do not everywhere occur at the same points in time. That is, the ranges of the defining taxa are not always filled. Thus, the length of time represented by a zone (but not, of course, its chronozone) can vary from place to place. These problems can be offset by use of chronostratigraphic modelling techniques such as Graphic Correlation. This technique was used to build a Cretaceous and Cenozoic model containing fossil, magnetopolarity, and other events. The scale of the model can be demonstrated to be linear with time. This model was used to determine the chronostratigraphic position of upper Eocene microspherule layers.

1488 (N–89-21287, pp. 76-77) **Impact wave deposits provide new constraints on the location of the K/T boundary impact.** Hildebrand, A.R.; Boynton, W.V. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

All available evidence is consistent with an impact into oceanic crust terminating the Cretaceous Period. Although much of this evidence is incompatible with an endogenic origin, some investigators still feel that a volcanic origin is possible for the Cretaceous/Tertiary (K/T) boundary clay layers. The commonly cited evidence for a large impact stems from delicate clay layers and their components and the impact site has not yet been found. Impact sites have been suggested all over the globe. The impact is felt to have occurred near North America by: the occurrence of a 2 cm thick ejecta layer only at North American locales, the global variation of shocked quartz grain sizes peaking in North America, the global variation of spinel compositions with most refractory compositions occurring in samples from the Pacific region and possibly uniquely severe plant extinctions in the North American region. The K/T boundary interval was investigated as preserved on the banks of the Brazos River, Texas. The K/T fireball and ejecta layers with associated geochemical anomalies were found interbedded with this sequence which apparently allows a temporal resolution 4 orders of magnitude greater than typical K/T boundary sections. A literature search reveals that such coarse deposits are widely preserved at the K/T boundary. Impact wave deposits have not been found elsewhere on the globe, suggesting the impact occurred between North and South America. The coarse deposits preserved in Deep Sea Drilling

Project (DSDP) holes 151-3 suggest the impact occurred nearby. Subsequent tectonism has complicated the picture.

1489 (N–89-21287, pp. 80) **Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause.** Hsue, K.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

Negative perturbations in carbon-isotope value of calcite in pelagic sediments were found at times of biotic crisis, marking horizons which are, or were proposed as era boundaries: Cretaceous/Tertiary (K/T), Permian/Triassic (P/T), and Precambrian/Cambrian (PreC/C). The anomaly was also found at several other mass-extinction horizons, such as terminal Ordovician, Frasnian-Famenian, etc. Studies of K/T boundary indicate that only the planktic fraction of the sediments has the negative isotope anomaly, whereas the benthic fraction has the same value across the boundary. This geochemical signal is thus considered a record of strangelove ocean, or an ocean where isotope fractionation of dissolved carbonate ions in surface waters (by biotic function of planktic organisms) has been significantly reduced because of the drastic reduction of the biomass in the oceans. The reduction of marine biomass at each of the era boundaries was related to chemical pollution of the oceans as a consequence of a catastrophic event; a pH decrease of 0.5 could inhibit the fertility of planktons. Studies of earthquakes, volcanic eruptions, and meteorite-impact occurrences have indicated a linearly inverse log/log relationship between the magnitude and frequency of events. The frequency of era boundaries in geologic history supports the postulate that the rare events causing those biotic crises were large bolide-impacts.

1490 (N–89-21287, pp. 82-82) **Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean.** Huffman, A.R.; Crocket, J.H.; Carter, N.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Sediments spanning a 5 meter section across the Cretaceous-Tertiary boundary at ODP holes 689B and 690D, Maud Rise, Wedell Sea and hole 527, Walvis Ridge, are being analyzed for shock deformation, PGE's and other trace elements (including REE's). Mineral separates from each sample were studied with optical microscopy to determine the distribution and microstructural state of quartz and feldspar present in the sediments. Samples from Maud Rise were taken of the K/T transition and at about 50 cm intervals above and below it. These samples consist of carbonate-rich sediments, with the K/T transition marked by a change from white Maastrichtian oozes to a greenish ooze with higher concentrations of altered volcanic clay and vitric ash. The Walvis Ridge site is characterized by more clay-rich sediments with average carbonate content about 60 to 70 percent. Initial results from RNAA studies indicate that iridium is present in all the Maud Rise samples in concentrations equal to or greater than 0.01 ppb (whole-rock basis). Preliminary results from optical microscopy indicate the occurrence of shock mosaicism in quartz and feldspar in all of the samples studied. The pervasiveness of shock mosaicism and presence of planar features to 2 meters from the K/T boundary indicates that a single impact or volcanic explosion 66 ma may be ruled out as responsible for the K/T event. A similar conclusion may be drawn independently from the distribution of iridium and other trace elements. Regardless of the source of the shock waves and sediment contamination, multiple events are required over a ca.0.5 my timespan; currently we favor endogenous sources.

1491 (N–89-21287, pp. 83-84) **Western North American Cretaceous-Tertiary (K-T) boundary interval and its content of shock-metamorphosed minerals: Implications concerning the K-T boundary impact-extinction theory.** Izett, G.A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

At 20 sites in the Raton Basin of Colorado and New Mexico, and at several other sites in Wyoming, Montana, and Canada, a pair of claystone units, an Ir abundance anomaly, and a concentration of shock-metamorphosed minerals mark the palynological K-T boundary. The K-T boundary claystone, which is composed of kaolinite and small amounts of illite/smectite mixed-layer clay, is similar in most respects to kaolinite tonstein layers in coal beds. At some, K-T boundary localities, the boundary claystone contains solid kaolinite and hollow and solid goyazite spherules, 0.05 to 1.2 mm in diameter. The upper unit, the K-T boundary impact layer, consists chiefly of kaolinite and various amounts of illite/smectite mixed-layer clay. The impact layer and boundary claystone are similar chemically, except that the former has slightly more Fe, K, Ba, Cr, Cu, Li, V, and Zn than the latter. The facts that the boundary claystone and impact layer contain anomalous amounts of Ir, comprise a stratigraphic couplet at Western North American sites, and form thin, discrete layers, similar to air-fall units (volcanic or impact), suggest that the claystone units are of impact origin. Significantly, the impact layer contains as much as 2 percent clastic mineral grains, about 30 percent of which contain multiple sets of shock lamellae. Only one such concentration of shocked minerals has been found near the K-T boundary. The type of K-T boundary shock-metamorphosed materials (quartzite and metaquartzite) in the impact layer and the lack of shock lamellae in quartz and feldspar of pumice lapilli and granitic xenoliths in air-fall pumice units of silicic tuffs, such as the Bishop Tuff, eliminate the possibility that the shock-metamorphosed minerals in the K-T impact layer are of volcanic origin. The global size distribution and abundance of shock-metamorphosed mineral grains suggest that the K-T impact occurred in North America.

1492 (N–89-21287, pp. 85-86) **Mass mortality and extraterrestrial impacts.** Jansa, L.F.; Gradstein, F.M.; Pierre-Aubry, M. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The discovery of iridium enrichment at the Cretaceous/Tertiary boundary resulted in formulation of hypothesis of a cometary or asteroid impact as the cause of the biological extinctions at this boundary. Subsequent discoveries of geochemical anomalies at major stratigraphic boundaries like the Precambrian/Cambrian, Permian/Triassic, Middle/Late Jurassic, resulted in the application of similar extraterrestrial impact theories to explain biological changes at these boundaries. Until recently the major physical evidence, as is the location of the impact crater site, to test the impact induced biological extinction was lacking. The diameter of such a crater would be in the range of 60 to 100 km. The recent discovery of the first impact crater in the ocean provide the first opportunity to test the above theory. The crater, named Montagnais and located on the outer shelf off Nova Scotia, Canada, has a minimum diameter of 42 km, with some evidence to a diameter of more than 60 km. At the Montagnais impact site, micropaleontological analysis of the uppermost 80 m of the fall-back breccia represented by a mixture of pre-impact sediments and basement rocks which fills the crater and of the basal 50 m of post-impact marine sediments which overly the impact deposits, revealed presence of diversified foraminiferal and nannoplankton assemblages. The sediments which are intercalated within the uppermost part of the fall-back breccia, had to be deposited before the meteorite impact. The post-impact deposits were laid down almost immediately after the impact as also supported by the micropaleontological data. In conclusion, micropaleontological studies of sediments from the first submarine impact crater site identified in the ocean did not reveal any mass extinction or significant biological changes at the impact site or in the proximal deep ocean basin.

1493 (N–89-21287, pp. 93-94) **Volcanic ash layers in blue ice fields (Beardmore Glacier Area, Antarctica): Iridium enrichments.** Koeberl, C. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Dust bands on blue ice fields in Antarctica have been studied and have been identified to originate from two main sources: bedrock debris scraped up from the ground by the glacial movement (these bands are found predominantly at fractures and shear zones in the ice near moraines), and volcanic debris deposited on and incorporated in the ice by large-scale eruptions of Antarctic (or sub-Antractic) volcanoes. Ice core studies have revealed that most of the dust layers in the ice cores are volcanic (tephra) deposits which may be related to some specific volcanic eruptions. These eruptions have to be related to some specific volcanic eruptions. These eruptions have to be relatively recent (a few thousand years old) since ice cores usually incorporate younger ice. In contrast, dust bands on bare blue ice fields are much older, up to a few hundred thousand years, which may be inferred from the rather high terrestrial age of meteorites found on the ice and from dating the ice using the uranium series method. Also for the volcanic ash layers found on blue ice fields correlations between some specific volcanoes (late Cenozoic) and the volcanic debris have been inferred, mainly using chemical arguments. During a recent field expedition samples of several dust bands found on blue ice fields at the Lewis Cliff Ice Tongue were taken. These dust band samples were divided for age determination using the uranium series method, and chemical investigations to determine the source and origin of the dust bands. The investigations have shown that most of the dust bands found at the Ice Tongue are of volcanic origin and, for chemical and petrological reasons, may be correlated with Cenozoic volcanoes in the Melbourne volcanic province, Northern Victoria Land, which is at least 1500 km away. Major and trace element data have been obtained and have been used for identification and correlation purposes.

1494 (N–89-21287, pp. 2) **Karskiy craters are the probable records of catastrophe at the Cretaceous-Tertiary boundary.** Kolesnikov, E.M.; Nazarov, M.A.; Badjukov, D.D.; Shukolyukov, Yu.A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

In order to corroborate the hypothesis of Alvarez and others about the connection of mass mortality and meteorite or cometary impact at the Cretaceous-Tertiary boundary, it is necessary to find a meteorite crater which was formed at the same time. Masaitiss suggested that the Karskiy craters (USSR) are suitable, but previous K/Ar data from other laboratories are very different (from 47 to 82 million years). Impact glasses were gathered from the Karskiy and Ust-Karskiy craters K/Ar age analyses were performed. The glasses cooled very rapidly and had the youngest model ages from 65.8 to 67.6 million years. The slower cooling crypto-crystalline aggregates had more ancient model ages, from 70.5 to 73.9 my as had tagamite because they captured excess argon during crystallization. Least squares analysis showed that with probability of 99 percent the findings on crypto-crystalline aggregates, tagamite and quartz glasses from the Karskiy and Ust-Karskiy craters lie on an isochron which has an age of 65.8 + or - 1.1 million years and a content of excess argon. For the two glasses with identical composition which have different quantities of secondary non-potassium minerals, an independent method determined the content of excess argon. Taking into account these data a more exact slope of the first isochron of 66.4 + or - 1.0 million years was observed and the second glass isochron with age 66.5 + or - 1.1 million years was constructed.

1495 (N–89-21287, pp. 75) **Selective extinction of marine plankton at the end of the Mesozoic era: The fossil and stable isotope record.** Herman, Y.; Bhattacharya, S.K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

Floral, faunal and stable isotope evidence in a continuous sequence of latest Cretaceous and earliest Tertiary shallow water marine deposits in the Mangyshlak Peninsula, USSR suggest severe environmental changes at the Cretaceous/Tertiary (K/T) boundary. Time frame is provided by nanno, micro and macrofossils as well as by magnetic stratigraphy and an iridium spike. Oxygen isotopic analyses of the bulk sediments, composed of nanno and microplankton skeletal remains, show a sharp positive spike at the K/T boundary. This shift is primarily attributed to severe cooling possibly accompanied by increased salinities of the surface mixed layer. Floral and faunal extinctions were selective, affecting approximately 90 percent of the warm water calcareous phyto and zooplankton genera in the Tethyan-Paratethyan regions. These highly diverse taxa with many endemic representatives were at the peak of their evolutionary development. Geologic evidence indicates that the terminal Cretaceous temperature decline was coeval with widespread and intense volcanic activity which reached a peak at the close of the Mesozoic Era. Increased acidity temporarily prohibited calcite nucleation of the surface dwelling warm-water plankton. Superimposed upon decreased alkalinity, severe and rapid climatic changes caused the extinction of calcareous phyto and zooplankton.

1496 (N–89-21287, pp. 104-105) **Catastrophic volcanism.** Lipman, P.W. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Since primitive times, catastrophes due to volcanic activity have been vivid in the mind of man, who knew that his activities in many parts of the world were threatened by lava flows, mudflows, and ash falls. Within the present century, increasingly complex interactions between volcanism and the environment, on scales not previously experienced historically, have been detected or suspected from geologic observations. These include enormous hot pyroclastic flows associated with collapse at source calderas and fed by eruption columns that reached the stratosphere, relations between huge flood basalt eruptions at hotspots and the rifting of continents, devastating laterally-directed volcanic blasts and pyroclastic surges, great volcanic-generated tsunamis, climate modification from volcanic release of ash and sulfur aerosols into the upper atmosphere, modification of ocean circulation by volcanic constructs and attendent climatic implications, global pulsations in intensity of volcanic activity, and perhaps triggering of some intense terrestrial volcanism by planetary impacts. Complex feedback between volcanic activity and additional seemingly unrelated terrestrial processes likely remains unrecognized. Only recently has it become possible to begin to evaluate the degree to which such large-scale volcanic processes may have been important in triggering or modulating the tempo of faunal extinctions and other evolutionary events. In this overview, such processes are examined from the viewpoint of a field volcanologist, rather than as a previous participant in controversies concerning the interrelations between extinctions, impacts, and volcanism.

1497 (N–89-21287, pp. 106-107) **Catastrophic volcanism as a cause of shocked features found at the K/T boundary and in cryptoexplosion structures.** Loper, D.E.; McCartney, K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The presence of quartz grains containing shock lamellae at the Cretaceous/Tertiary (K/T) boundary is viewed by many as the single most compelling evidence of meteoritic or cometary impact because

there is no known endogenous mechanism for producing these features. Similarly the presence of shocked quartz, shatter cones, coesite and stishovite at cryptoexplosion structures is comonly taken as conclusive evidence of impact. However, several recent studies have cast doubt on this interpretation. It is argued that basaltic volcanism, although not normally explosive, can under exceptional circumstances produce overpressures sufficiently high to produce shock features. The exceptional circumstances include a high content of volatiles, usually CO2, and no preestablished pathway to the surface. Rapid cooling of the saturated basaltic magma can occur if it underlies a cooler more evolved magma in a chamber. Initial slow cooling and partial exsolution of the volatiles will cause the density of the basaltic magma to become less than that of the overlying magma, leading to overturning and mixing. Gas will escape the magma chamber along planar cracks once the pressure becomes sufficiently high. In the vicinity of the crack tip there is a smallscale deviatoric stress pattern which is thought to be sufficiently high to produce transient cracks along secondary axes in the quartz crystals, causing the planar features. The CO2-rich fluid inclusions which have been found along planar elements of quartz in basement rocks of the Vredefort Dome were likely to have been emplaced by such a process. If the mechanism described is capable of producing shocked features as above, it would require a reassessment of the origin of many cryptoexplosion structures as well as seriously weakening the case for an impact origin of the K/T event.

1498 (N–89-21287, pp. 111) **Seawater strontium isotopes at the Cretaceous-Tertiary boundary.** MacDougall, J.D.; Martin, E. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Anomalously high values of Seawater Sr-87/Sr-86 near the Cretaceous-Tertiary (K-T) boundary have been reported. However, few of the data from the literature are from a single continuous section, and perhaps the most complete study of the boundary region, from a shallow marine limestone sequence in Alabama, showed elevated Sr-87/Sr-86 but no pronounced spike. Thus, in order to investigate the cause of the change in strontium isotopic composition, it is important to determine the exact nature and magnitude of the increase by studying in detail continuous sections through the boundary. If there is indeed a Sr isotope spike at the K-T boundary, it requires the addition of a large amount of radiogenic Sr to the oceans over a short time period, a phenomenon that may be linked to other large-scale environmental disturbances which occurred at that time. In order to address this question, a high-resolution strontium isotope study of foraminifera from three Deep Sea Drilling Project (DSDP) cores which recovered the K-T boundary section: Site 356 in the South Atlantic, Site 384 in the North Atlantic and Site 577 from the Shatsky Rise in the Pacific was initiated. The isotope measurements are being made on either single or small numbers of forams carefully picked and identified and in most cases examined by SEM before analysis. Because this work is not yet complete, conclusions drawn here must be viewed as tentative. They are briefly discussed.

1499 (N–89-21287, pp. 112) **Inducement of heterochronic variation in a species of planktic foraminifera by a Late Eocene impact event.** MacLeod, N.; Kitchell, J.A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

While it is well known that the cosmic impact event at or near the Cretaceous-Tertiary boundary coincides with an interval of mass extinction, a similar impact (or series of impacts) near the Eocene-Oligocene boundary presents a more complex picture, in terms of associated fluctuations in marine biotic diversity. Tektites, microtektites, and mineral grains exhibiting features of shock metamorphism found in Eocene sediments of the western N. Atlantic, Caribbean, and Gulf of Mexico (comprising the North American microtektite strewn field) offer compelling evidence for a catastrophic impact event. Despite the magnitude of this event, however, few extinctions in the planktic marine fauna are known to have occurred coincident with this event. Instead, changes in relative abundance, morphology, and development occurred. Cosmic impacts generally have been interpreted as influencing the course of evolution through the wholesale elimination of significant portions of standing biotic diversity. Indeed, extinction traditionally has been viewed as the negative side of evolution. In some instances, it is suggested such impact events can serve instead to increase, rather than decrease, morphological and ecological diversity, by altering the developmental programs within species at the level of the local population.

1500 (N–89-21287, pp. 113-114) **Trace element and isotope geochemistry of Cretaceous-Tertiary boundary sediments: identification of extra-terrestrial and volcanic components.** Margolis, S.V.; Doehne, E.F. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Trace element and stable isotope analyses were performed on a series of sediment samples crossing the Cretaceous-Tertiary (K-T) boundary from critical sections at Aumaya and Sopelano, Spain. The aim is to possibly distinguish extraterrestrial vs. volcanic or authigenic concentration of platinum group and other elements in K-T boundary transitional sediments. These sediments also have been shown to contain evidence for step-wise extinction of several groups of marine invertebrates, associated with negative oxygen and carbon isotope excursions occurring during the last million years of the Cretaceous. These isotope excursions have been interpreted to indicate major changes in ocean thermal regime, circulation, and ecosystems that may be related to multiple events during latest Cretaceous time. Results to date on the petrographic and geochemical analyses of the Late Cretaceous and Early Paleocene sediments indicate that diagenesis has obviously affected the trace element geochemistry and stable isotope compositions at Zumaya. Mineralogical and geochemical analysis of K-T boundary sediments at Zumaya suggest that a substantial fraction of anomalous trace elements in the boundary marl are present in specific mineral phases. Platinum and nickel grains perhaps represent the first direct evidence of siderophile-rich minerals at the boundary. The presence of spinels and Ni-rich particles as inclusions in aluminosilicate spherules from Zumaya suggests an original, nondiagenetic origin for the spherules. Similar spherules from southern Spain (Caravaca), show a strong marine authigenic overprint. This research represents a new approach in trying to directly identify the sedimentary mineral components that are responsible for the trace element concentrations associated with the K-T boundary.

1501 (N–89-21287, pp. 117) **Step-wise extinctions at the Cretaceous-Tertiary boundary and their climatic implications.** Maurrasse, F.J.M.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

A comparative study of planktonic foraminifera and radiolarian assemblages from the Cretaceous-Tertiary (K-T) boundary section of the Beloc Formation in the southern Peninsula of Haiti, and the lowermost Danian sequence of the Micara Formation in southern Cuba reveals a remarkable pattern of step-wise extinctions. This pattern is consistent in both places despite the widely different lithologies of the two formations. Because of a step-wise extinction and the delayed disappearance of taxa known to be more representative of cooler water realms, it is inferred that a cooling trend which characterized the close of the Maastrichtian and the onset of the Tertiary had the major adverse effect on the existing biota. Although repetitive lithologic and faunal fluctuations throughout the Maastrichtian sediments found at Deep Sea Drilling Project (DSDP) site 146/149 in the Caribbean Sea indicate variations reminiscent of known climatically induced cycles in the Cenozoic, rapid biotic succession appears to have taken place during a crisis period of a duration

greater than 2 mission years. Widespread and abundant volcanic activities recorded in the Caribbean area during the crisis period gives further credence to earlier contention that intense volcanism may have played a major role in exhacerbating pre-existing climatic conditions during that time.

1502 (N–89-21287, pp. 120) **Mass killings and detection of impacts.** McLaren, D.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

Highly energetic bolide impacts occur and their flux is known. For larger bodies the energy release is greater than for any other short-term global phenomenon. Such impacts produce or release a large variety of shock induced changes including major atmospheric, sedimentologic, seismic and volcanic events. These events must necessarily leave a variety of records in the stratigraphic column, including mass killings resulting in major changes in population density and reduction or extinction of many taxonomic groups, followed by characteristic patterns of faunal and flora replacement. Of these effects, mass killings, marked by large-scale loss of biomass, are the most easily detected evidence in the field but must be manifest on a near-global scale. Such mass killings that appear to be approximately synchronous and involve disappearance of biomass at a bedding plane in many sedimentologically independent sections globally suggest a common cause and probable synchroneity. Mass killings identify an horizon which may be examined for evidence of cause. Geochemical markers may be ephemeral and absence may not be significant. There appears to be no reason why ongoing phenomena such as climate and sea-level changes are primary causes of anomolous episodic events.

1503 (N–89-21287, pp. 122-123) **Calvin 28 cryptoexplosive disturbance, Cass County, Michigan: Evidence for impact origin.** Milstein, R.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Calvin 28 cryptoexplosive disturbance is an isolated, nearly circular subsurface structure of Late Ordovician age in southwestern Michigan. The structure is defined by 107 wells, is about 7.24 km in diameter and consists of a central dome, an annular depression and an encircling anticlinal rim. Seismic and geophysical well log data confirm that an intricate system of faults and structural derangement exists within the structure. Deformation decreases with depth and distance from the structure. U.S.G.S. topographic maps and aerial imagery show the structure is reflected as a subtle surface topographic rise controlling local drainage. Igneous or diapiric intrusion and solution collapse are rejected as possible origins for Calvin 28 on the basis of stratigraphic, structural and geophysical evidence. A volcanic origin is inconsistent with calculated energy requirements and an absence of igneous material. Although shock-metamorphic features are unidentified, microbreccias occur in deep wells that penetrate the structure. Morphology and structural parameters support an impact origin.

1504 (N–89-21287, pp. 124-125) **Mineralogical and geochemical anomalous data of the K-T boundary samples.** Miura, Y.; Shibya, G.; Imai, M.; Takaoka, N.; Saito, S. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Cretaceous-Tertiary boundary problem has been discussed previously from the geological research, mainly by fossil changes. Although geochemical bulk data of Ir anomaly suggest the extraterrestrial origin of the K-T boundary, the exact formation process discussed mainly by mineralogical and geochemical study has been started recently, together with noble gas contents. The K-T boundary sample at Kawaruppu River, Hokkaido was collected, in order to compare with the typical K-T boundary samples of Bubbio, Italy, Stevns Klint, Denmark, and El Kef, Tunisia. The experimental data of the silicas and calcites in these K-T boundary samples were obtained from the X-ray unit-cell dimension (i.e., density), ESR signal and total linear absorption coefficient, as well as He and Ne contents. The K-T boundary samples are usually complex mixture of the terrestrial activities after the K-T boundary event. The mineralogical and geochemical anomalous data indicate special terrestrial atmosphere at the K-T boundary formation probably induced by asteroid impact, followed the many various terrestrial activities (especially the strong role of sea-water mixture, compared with terrestrial highland impact and impact craters in the other earth-type planetary bodies).

1505 (N–89-21287, pp. 126) **Flood basalts and mass extinctions.** Morgan, W.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

There appears to be a correlation between the times of flood basalts and mass-extinction events. There is a correlation of flood basalts and hotspot tracks–flood basalts appear to mark the beginning of a new hotspot. Perhaps there is an initial instability in the mantle that bursts forth as a flood basalt but then becomes a steady trickle that persists for many tens of millions of years. Suppose that flood basalts and not impacts cause the environmental changes that lead to mass-extinctions. This is a very testable hypothesis: it predicts that the ages of the flows should agree exactly with the times of extinctions. The Deccan and K-T ages agree with this hypothesis; An iridium anomaly at extinction boundaries apparently can be explained by a scaled-up eruption of the Hawaiian type; the occurrence of shocked-quartz is more of a problem. However if the flood basalts are all well dated and their ages indeed agree with extinction times, then surely some mechanism to appropriately produce shocked-quartz will be found.

1506 (N–89-21287, pp. 128-129) **Deccan volcanism and K-T boundary signatures.** Murali, A.V.; Schuraytz, B.C.; Parekh, P.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Deccan Traps in the Indian subcontinent represent one of the most extensive flood basalt provinces in the world. These basalts occur mainly as flat-lying, subaerially erupted tholeiitic lava flows, some of which are traceable for distances of more than 100 km. Offshore drilling and geophysical surveys indicate that a part of the Deccan subsided or was downfaulted to the west beneath the Arabian Sea. The presence of 1 to 5 m thick intertrappean sediments deposited by lakes and rivers indicates periods of quiescence between eruptions. The occurrence of numerous red bole beds among the flows suggests intense weathering of flow tops between eruptive intervals. Although the causative relationship of the Cretaceous-Tertiary (K-T) biotic extinctions to Deccan volcanism is debatable, the fact that the main Deccan eruptions straddle the K-T event appears beyond doubt from the recent Ar-40/Ar-39 ages of various Deccan flows. This temporal relationship of the K-T event with Deccan volcanism makes the petrochemical signatures of the entire Deccan sequence (basalt flows, intercalated intertrappean sediments, infratrappean Lameta beds (with dinosaur fossils), and the bole beds) pertinent to studies of the K-T event. The results of ongoing study is presented.

1507 (N–89-21287, pp. 130-131) **Plant microfossil record of the terminal Cretaceous event in the western United States and Canada.** Nichols, D.J.; Fleming, R.F. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history:*

An interdisciplinary conference on impacts, volcanism, and mass mortality. Available from NTIS, PC A11/MF A01.

Plant microfossils, principally pollen grains and spores produced by land plants, provide an excellent record of the terminal Cretaceous event in nonmarine environments. The record indicates regional devastation of the latest Cretaceous vegetation with the extinction of many groups, followed by a recolonization of the earliest Tertiary land surface, and development of a permanently changed land flora. The regional variations in depositional environments, plant communities, and paleoclimates provide insight into the nature and effects of the event, which were short-lived but profound. The plant microfossil data support the hypothesis that an abruptly initiated, major ecological crisis occurred at the end of the Cretaceous. Disruption of the Late Cretaceous flora ultimately contributred to the rise of modern vegetation. The plant microfossils together with geochemical and mineralogical data are consistent with an extraterrestrial impact having been the cause of the terminal Cretaceous event.

1508 (N–89-21287, pp. 132) **Cretaceous-Tertiary findings, paradigms and problems.** Officer, C.B.; Drake, C.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

The asteroid hypothesis has stimulated numerous studies of the paleontological record at Cretaceous/Tertiary time as well as of geological indicators of environmental crisis preserved in the rock record. Both extinctions and geological anomalies often occur at times that do not appear to be synchronous or instantaneous. The record includes paleontological indicators of dinosaurs, terrestrial flora, marine planktonic organisms, and shallow water marine macrofauna and geological phenomena include occurrences of iridium and other platinum metals, trace elements, clay mineralogy, shocked minerals, soot, microspherules, and isotopes of osmium, strontium and carbon. These findings are reviewed in the context of the alternate hypotheses of an exogenic cause, involving either a single asteroid impact or multiple commentary impacts, and an endogenic cause, involving intense global volcanism and major sea level regression.

1509 (N–89-21287, pp. 133-134) **Environmental effects of large impacts on the earth; relation to extinction mechanisms.** Okeefe, J.D.; Ahrens, T.J.; Koschny, D. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Since Alvarez et al., discovered a worldwide approx. cm-thick layer of fine sediments laden with platinum group elements in approximately chondritic proportions exactly at the Cretaceous-Tertiary (C-T) boundary, and proposed bolide-impact as triggering mass extinctions, many have studied this hypothesis and the layer itself with its associated spherules and shocked quartz. At issue is whether the mass extinctions, and this horizon has an impact versus volcanic origin. A critical feature of the Alvarez hypothesis is the suggestion that the bolide or possibly a shower of objects delivered to the earth approx. 0.6 x 10 to the 18th power g of material which resulted in aerosol-sized ejecta such that global insolation was drastically reduced for significant periods. Such an event would lower temperatures on continents and halt photosynthesis in the upper 200 m of th eocean. The latter would strangle the marine food chain and thus produce the major marine faunal extinctions which mark the C-T boundary. Crucial issues examined include: What are the dynamics of atmospheric flow occurring upon impact of a large bolide with the earth; What is the size distributions of the very fine impact ejecta and how do these compare to the models of ejecta which are used to model the earth's radiative thermal balance. The flow field due to passage of a 10 km diameter bolide through an exponential atmosphere and the interaction of the gas flow and bolide with the solid ear was calculated. The CO2 released upon impact onto shallow marine carbonate sections was modeled and found that the mass of CO2 released exceeds the present 10 to the 18th power g CO2 budget of the earth's atmosphere by several times.

1510 (N–89-21287, pp. 137-138) **Permo-Triassic vertebrate extinctions: A program.** Olson, E.C. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Since the time of the Authors' study on this subject, a great deal of new information has become available. Concepts of the nature of extinctions have changed materially. The Authors' conclusion that a catastrophic event was not responsible for the extinction of vertebrates has modified to the extent that hypotheses involving either the impact of a massive extra-terrestrial body or volcanism provide plausible but not currently fully testable hypotheses. Stated changes resulted in a rapid decrease in organic diversity, as the ratio of origins of taxa to extinctions shifted from strongly positive to negative, with momentary equilibrium being reached at about the Permo-Triassic boundary. The proximate causes of the changes in the terrestrial biota appear to lie in two primary factors: (1) strong climatic changes (global mean temperatures, temperature ranges, humidity) and (2) susceptibility of the dominant vertebrates (large dicynodonts) and the glossopteris flora to disruption of the equlibrium of the world ecosystem. The following proximate causes have been proposed: (1) rhythmic fluctuations in solar radiation, (2) tectonic events as Pangea assembled, altering land-ocean relationships, patterns of wind and water circulation and continental physiography, (3) volcanism, and (4) changes subsequent to impacts of one or more massive extra terrestrial objects, bodies or comets. These hypotheses are discussed.

1511 (N–89-21287, pp. 141-142) **Cathodoluminescence of shocked quartz at the Cretaceous-Tertiary boundary.** Owen, M.R.; Anders, M.H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Empirical studies have documented an association between rock type and the cathodoluminescence color of constituent quartz grains. Quartz from extrusive igneous sources luminesces uniform pale blue. Quartz from intrusive igneous and high-grade metamorphic rocks generally luminesces darker purple-blue, whereas quartz recrystallized under low-grade metamorphic conditions luminesces reddish-brown. Quartz grains in most sandstones luminesce a heterogeneous mixture of these colors because the grains were derived from a variety of ultimate source rocks. If shocked quartz found at the Cretaceous-Tertiary (K-T) boundary is volcanic in origin, its cathodoluminescence should be predominantly pale blue. Alternatively, quartz grains derived from bolide impact upon, and ejection of, mixed igneous, metamorphic, and sedimentary rocks should luminesce a variety of colors. Grain mounts of sand collected at the K-T boundary horizon from the Clear Creek North site in the Raton Basin, Colorado were examined. Shocked quartz luminesced a variety of colors and very few grains luminesced the pale blue color that is typical of volcanic quartz. It was concluded that the shocked quartz was derived from a petrologically diverse source region without substantial volcanic contribution. Most shocked grains apparently were derived from low-grade metamorphic rocks, with a slightly smaller contribution from high-grade metamorphic and intrusive igneous rocks. Rare quartz grains with brown-luminescing rims reflect a minor addition from detrital sedimentary sources. The apparent relative abundances of intrusive (and rare extrusive) igneous, metamorphic, and sedimentary ultimate source rocks suggested by CL colors of shock-deformed quartz at the K-T boundary is consistent with a crustal/supracrustal origin for the grains.

1512 (N–89-21287, pp. 143-144) **Bio-, Magneto- and event-stratigraphy across the K-T boundary.** Preisinger, A.

(Montanuniversitat Leoben (Austria)); Stradner, H.; Mauritsch, H.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Determining the time and the time structure of rare events in geology can be accomplished by applying three different and independent stratigraphic methods: Biostratigraphy, magnetostratigraphy and event-stratigraphy. The optimal time resolution of the two former methods is about 1000 years, while by means of event-stratigraphy a resolution of approximately one year can be achieved. For biostratigraphy across the Cretaceous-Tertiary (K-T) boundary micro- and nannofossils have been found best suited. The qualitative and quantitative analyses of minerals and trace elements across the K-T boundary show anomalies on a millimeter scale and permit conclusions regarding the time structure of the K-T event itself. The results of the analyses find a most consistent explanation by the assumption of an extraterrestrial impact. The main portion of the material rain from the atmosphere evidently was deposited within a short time. The long-time components consist of the finest portion of the material rain from the atmosphere and the transported and redeposited fall-out.

1513 (N–89-21287, pp. 145) **Biospheric traumas caused by large impacts and predicted relics in the sedimentary record.** Prinn, R.G.; Fegley, B. Jr. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

When a large asteroid or comet impacts the Earth the supersonic plume ejected on impact causes severe shock heating and chemical reprocessing of the proximal atmosphere. The resultant NO is converted rapidly to NO2, foliage damage due to exposure to NO2 and HNO3, toxicosis resulting from massive mobilization of soil trace metals, and faunal asphyxiation due to exposure to NO2. One class of relic evidence for the above effects arises because extinction of species caused by these chemically induced traumas would be selective. A second class of relic evidence arises because the acid rain will cause massive weathering of continental rocks and soils characterized by large ratios of the relatively insoluble metals, to the more soluble metals. This weathering would be best recorded in fossils in unperturbed deltaic, neritic, or limnetic sediments and for metals with very long oceanic residence times in deep ocean sediments as well. This evidence is discussed.

1514 (N–89-21287, pp. 146) **Flood basalt eruptions, comet showers, and mass extinction events.** Rampino, M.R. (National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD (USA)); Stothers, R.B. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

A chronology of initiation dates of the major continental flood basalt episodes has been established from compilation of published K-Ar and Ar-Ar ages of basaltic flows and related basic intrusions. The dating is therefore independent of the biostratigraphic and paleomagnetic time scales, and the estimated errors of the inititation dates are approximately + or - 4 pct. There are 11 distinct episodes of continental flood basalts known during the past 250 Myr. The data show that flood basalt episodes are generally relatively brief geologic events, with intermittent eruptions during peak output periods lasting ony 2 to 3 Myr or less. Statistical analyses suggest that these episodes may have occurred quasi-periodically with a mean cycle time of 32 + or - 1 Myr. The initiation dates of the flood basalts are close to the estimated dates of marine mass extinctions and impact-crater clusters. Although a purely internal forcing might be argued for the flood basalt volcanism, quasi-periodic comet impacts may be the trigger for both the flood basalts and the extinctions. Impact cratering models suggest that large-body impactors lead to deep initial cratering, and therefore may cause mantle disturbances and initiate mantle plume activity. The flood basalt episodes commonly mark the initiation or jump of a mantle hotspot, and are often followed by continental rifting and separation. Evidence from dynamical studies of impacts, occurrences of craters and hotspots, and the geochemistry of boundary layers is synthesized to provide a possible model of impact-generated volcanism. Flood basalt eruptions may themselves have severe effects on climate, and possibly on life. Impacts might, as a result, have led to mass extinctions through direct atmospheric disturbances, and/or indirectly through prolonged flood basalt volcanism.

1515 (N–89-21287, pp. 147) **Climatic changes resulting from mass extinctions at the K-T boundary (and other bio-events).** Rampino, M.R.; Volk, T. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

The mass extinctions at the Cretaceous-Tertiary (K-T) boundary include about 90 percent of marine calcareous nannoplankton (coccoliths), and carbon-isotope data show that marine primary productivity was drastically reduced for about 500,000 years after the boundary event, the so-called Strangelove Ocean effect. One result of the elimination of most marine phytoplankton would have been a severe reduction in production of dimethyl sulfide (DMS), a biogenic gas that is believed to be the major precursor of cloud condensation nuclei (CCN) over the oceans. A drastic reduction in marine CCN should lead to a cloud canopy with significantly lower reflectivity, and hence cause a significant warming at the earth's surface. Calculations suggest that, all other things being held constant, a reduction in CCN of more than 80 percent (a reasonable value for the K-T extinctions) could have produced a rapid global warming of 6 C or more. Oxygen-isotope analyses of marine sediments, and other kinds of paleoclimatic data, have provided for a marked warming, and a general instability of climate coincident with the killoff of marine plankton at the K-T boundary. Similar reductions in phytoplankton abundance at other boundaries, as indicated by marked shifts in carbon-isotope curves, suggest that severe temperature changes may have accompanied other mass extinctions, and raises the intriguing possibility that the extinction events themselves could have contributed to the climatic instabilities at critical bio-events in the geologic record.

1516 (N–89-21287, pp. 148-149) **Impact as a general cause of extinction: A feasibility test.** Raup, D.M. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Large body impact has been implicated as the possible cause of several extinction events. This is entirely plausible if one accepts two propositions: (1) that impacts of large comets and asteroids produce environmental effects severe enough to cause significant species extinctions and (2) that the estimates of comet and asteroid flux for the Phanerozoic are approximately correct. A resonable next step is to investigate the possibility that impact could be a significant factor in the broader Phanerozoic extinction record, not limited merely to a few events of mass extinction. Monte Carlo simulation experiments based on existing flux estimates and reasonable predictions of the relationship between bolide diameter and extinction are discussed. The simulation results raise the serious possibility that large body impact may be a more pervasive factor in extinction than has been assumed heretofore. At the very least, the experiments show that the comet and asteroid flux estimates combined with a reasonable kill curve produces a reasonable extinction record, complete with occasional mass extinctions and the irregular, lower intensity extinctions commonly called background extinction.

1517 (N–89-21287, pp. 150-151) **Report on an International workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure.** Reimold, W.U. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Eighty-five geoscientists gathered in the heart of the Vredefort Cryptoexplosion structure to discuss and evaluate the current knowledge about mass extinctions, impact and volcanic cratering and to obtain first-hand information on the Vredefort structure and its origin. Presentations were made within 8 topical sessions: (1) the regional setting of the Vredefort structure; (2) the Vredefort structure itself; (3) deformations and microdeformations; (4) large cryptoexplosion structures; (5) the Ries Crater; (6) tektites; (7) the K-T boundary, and (8) tectonophysics of cratering. The program was rounded up by working group and plenum discussions culminating in a Workshop report emphasizing problem areas, gaps in the data base and recommendations for future research.

1518 (N–89-21287, pp. 154-155) **Dynamics of exploding magma chambers: Implications for K-T volcanism and mass extinctions.** Rice, A.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Although it is well known that unconfined chemical explosives may yield pressures to several megabars on detonation in air, the explosive literature has yet to be accessed by some contributors to the volcanological literature who've indicated that pressures in excess of the overburden and/or tensile cannot be obtained. Idealized ballistic assessments of pressures internal to volcanoes yield pressures in the hundreds of kilobar range upon correction by addition of friction, etc. Previous assessments of exploding magma chamber pressure have been made from the characteristics of the Mt. St. Helens explosion. A variety of methods yield pressures of similar value: at least hundreds of kilobars. Such results are consistent with free energy requirements for quench supersaturation explosion, a process occurring in solidifying industrial melts. Several reviews of geochemical literature emphasize the carbon event at the Cretaceous-Tertiary (K-T) boundary as being an indicator of a massive dump of CO2 derived from the mantle and entering the atmosphere by extensive global volcanism. Oxygen isotope data indicates extreme warming at the end of the Cretaceous which is consistent with a greenhouse effect attending the CO2 event. Reaction rate equations for the quench supersaturation explosion mechanism indicated, are consistent with the rise in pressure to 30 kbar on solidification of magmatic melts, these pressures limited by the strength of the experimental apparatus.

1519 (N–89-21287, pp. 162-163) **Crater size estimates for large-body terrestrial impact.** Schmidt, R.M.; Housen, K.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Calculating the effects of impacts leading to global catastrophes requires knowledge of the impact process at very large size scales. This information cannot be obtained directly but must be inferred from subscale physical simulations, numerical simulations, and scaling laws. Schmidt and Holsapple presented scaling laws based upon laboratory-scale impact experiments performed on a centrifuge (Schmidt, 1980 and Schmidt and Holsapple, 1980). These experiments were used to develop scaling laws which were among the first to include gravity dependence associated with increasing event size. At that time using the results of experiments in dry sand and in water to provide bounds on crater size, they recognized that more precise bounds on large-body impact crater formation could be obtained with additional centrifuge experiments conducted in other geological media. In that previous work, simple power-law formulae were developed to relate final crater diameter to impactor size and velocity. In addition, Schmidt (1980) and Holsapple and Schmidt (1982) recognized that the energy scaling exponent is not a universal constant but depends upon the target media. Recently, Holsapple and Schmidt (1987) includes results for non-porous materials and provides a basis for estimating crater formation kinematics and final crater size. A revised set of scaling relationships for all crater parameters of interest are presented. These include results for various target media and include the kinematics of formation. Particular attention is given to possible limits brought about by very large impactors.

1520 (N–89-21287, pp. 164-165) **Marine and continental K-T boundary clays compared.** Schmitz, B. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Detailed geochemical and mineralogical studies (1 to 5) of sediments across the Cretaceous-Tertiary (K-T) boundary at Stevns Klint, Karlstrup, Nye Klov, Dania, and Kjolby Gaard in Denmark, at Limhamn in Sweden, at Caravaca in Spain, at Waipara and Woodside Creek in New Zealand, at Trinidad in Colorado, and at various sites in Montana, have induced conclusions and reflections which are given and briefly discussed.

1521 (N–89-21287, pp. 166-167) **Oblique impacts: Catastrophic vs. protracted effects.** Schultz, P.H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Proposed impacts as the cause of biologic catastrophes at the end of the Cretaceous and Eocene face several enigmas: protracted extinctions, even prior to the stratigraphic cosmogenic signature; widespread but non-uniform dispersal of the meteoritic component; absence of a crater of sufficient size; and evidence for massive intensive fires. Various hypotheses provide reasonable mechanisms for mass mortalities: global cooling by continental impact sites; global warming by oceanic impact sites; contrasting effects of asteroidal, cometary, and even multiple impacts; and stress on an already fragile global environment. Yet not every known large impact is associated with a major biologic catastrophe. An alternative is expanded: the consequences of an oblique impact. The most probable angle of impact is 45 deg with the probability for an impact at smaller angles decreasing: A vertical impact is as rare as a tangential impact with a 5 deg impact angle or less occurring only 8 percent of the time. Consequently a low-angle impact is a rare but probable event. Laboratory experiments at the NASA-Ames Vertical Gun Range reveal important information about cratering efficiency, impact vaporization, projectile dispersal, and phenomenology, thereby providing perspective for possible consequences of such an impact on both the Earth and Moon. Oblique impacts are rare but certain events through geologic time: A 5 deg impact by a 2 km-diameter impactor on the Earth would occur only once in about 18 my with a 10 km-diameter once in about 450 my. Major life extinctions beginning prior to the stratigraphic cosmogenic signature or protracted extinctions seemingly too long after the proposed event may not be evidence against an impact as a cause but evidence for a more complex but probable sequence of events.

1522 (N–89-21287, pp. 170-171) **Periodicity of extinction: A 1988 update.** Sepkowski, J.J. Jr. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The hypothesis that events of mass extinction recur periodically at approximately 26 my intervals is an empirical claim based on

analysis of data from the fossil record. The hypothesis has become closely linked with catastrophism because several events in the periodic series are associated with evidence of extraterrestrial impacts, and terrestrial forcing mechanisms with long, periodic recurrences are not easily conceived. Astronomical mechanisms that have been hypothesized include undetected solar companions and solar oscillation about the galactic plane, which induce comet showers and result in impacts on Earth at regular intervals. Because these mechanisms are speculative, they have been the subject of considerable controversy, as has the hypothesis of periodicity of extinction. In response to criticisms and uncertainties, a data base was developed on times of extinction of marine animal genera. A time series is given and analyzed with 49 sample points for the per-genus extinction rate from the Late Permian to the Recent. An unexpected pattern in the data is the uniformity of magnitude of many of the periodic extinction events. Observations suggest that the sequence of extinction events might be the result of two sets of mechanisms: a periodic forcing that normally induces only moderate amounts of extinction, and independent incidents or catastrophes that, when coincident with the periodic forcing, amplify its signal and produce major-mass extinctions.

1523 (N–89-21287, pp. 172-173) **K-T impact(s): Continental, oceanic or both.** Sharpton, V.L.; Schuraytz, B.C.; Murali, A.V.; Ryder, G.; Burke, K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Although geochemical and mineralogical evidence indicate that a major accretionary event occurred at the K-T boundary, no impact crater of suitable size and age was recognized. The 35 km Manson Structure, Iowa, was suggested recently as a possibility and Ar-40/Ar-39 determinations indicate that its formation age is indistinguishable from that of the K-T boundary. In order to test a possible association between Manson and the K-T boundary clay, the geochemistry and mineralogy of the K-T boundary clays at the Scollard Canyon section, Alberta and the Starkville South section, Colorado are compared with three dominant lithologies affected by the Manson impact: Proterozoic red clastics, underlying late-state granites, and gneisses. The chemical and mineralogical makeup of the Scollard Canyon boundary clay and its clastic constituents are presented, commenting on the implications for impact models. An impact into crystalline material of continental affinity appears to be required to explain the mineralogy and chemistry of the Scollard Canyon (and other Western N. American K-T sections). The low REE abundances of some K-T boundary layers are unusual but perhaps attempts should be made to understand the contributions of individual crustal components (e.g., carbonates, arkoses) as well as the potential for alteration involving these and other elements during and after impact-induced vaporization, before mantle excavation is invoked. If further studies confirm the results of published studies of marine boundary clays that indicate an oceanic target, attention must be paid to the possibility that multiple impacts occurred at the K-T boundary - one or more on the continents and one or more in the ocean.

1524 (N–89-21287, pp. 177-178) **Assessment of the atmospheric impact of volcanic eruptions.** Sigurdsson, H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The dominant global impact of volcanic activity is likely to be related to the effects of volcanic gases on the Earth's atmosphere. Volcanic gas emissions from individual volcanic arc eruptions are likely to cause increases in the stratospheric optical depth that result in surface landmass temperature decline of 2 to 3 K for less than a decade. Trachytic and intermediate magmas are much more effective in this regard than high-silica magmas, and may also lead to extensive ozone depletion due to effect of halogens and magmatic water. Given the assumed relationship between arc volcanism and subduction rate, and the relatively small variation in global spreading rates in the geologic record, it is unlikely that the rates of arc volcanism have varied greatly during the Cenozoic. Hotspot related basaltic fissure eruptions in the subaerial environment have a higher mass yield of sulfur, but lofting of the valcanic aerosol to levels above the tropopause is required for a climate impact. High-latitude events, such as the Laki 1783 eruption can easily penetrate the tropopause and enter the stratosphere, but formation of a stratospheric volcanic aerosol form low-latitude effusive basaltic eruptions is problematical, due to the elevated low-latitude tropopause. Due to the high sulfur content of hotspot-derived basaltic magmas, their very high mass eruption rates and the episodic behavior, hotspots must be regarded as potentially major modifiers of Earth's climate through the action of their volcanic volatiles on the chemistry and physics of the atmosphere.

1525 (N–89-21287, pp. 179) **Volcanoes and global catastrophes.** Simkin, T. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The search for a single explanation for global mass extinctions has led to polarization and the controversies that are often fueled by widespread media attention. The historic record shows a roughly linear log-log relation between the frequency of explosive volcanic eruptions and the volume of their products. Eruptions such as Mt. St. Helens 1980 produce on the order of 1 cu km of tephra, destroying life over areas in the 10 to 100 sq km range, and take place, on the average, once or twice a decade. Eruptions producing 10 cu km take place several times a century and, like Krakatau 1883, destroy life over 100 to 1000 sq km areas while producing clear global atmospheric effects. Eruptions producting 10,000 cu km are known from the Quaternary record, and extrapolation from the historic record suggests that they occur perhaps once in 20,000 years, but none has occurred in historic time and little is known of their biologic effects. Even larger eruptions must also exist in the geologic record, but documentation of their volume becomes increasingly difficult as their age increases. The conclusion is inescapable that prehistoric eruptions have produced catastrophes on a global scale: only the magnitude of the associated mortality is in question. Differentiation of large magma chambers is on a time scale of thousands to millions of years, and explosive volcanoes are clearly concentrated in narrow belts near converging plate margins. Volcanism cannot be dismissed as a producer of global catastrophes. Its role in major extinctions is likely to be at least contributory and may well be large. More attention should be paid to global effects of the many huge eruptions in the geologic record that dwarf those known in historic time.

1526 (N–89-21287, pp. 180-181) **Biostratigraphic case studies of six major extinctions.** Sloan, R.E. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Biostratigraphic case studies of six major extinctions show all are gradual save one, which is a catastrophic extinction of terrestrial origin. These extinctions show a continuum of environmental insults from major to minor. The major causes of these extinctions are positive and negative eustatic sea level changes, temperature, or ecological competition. Extraterrestrial causes should not be posited without positive association with a stratigraphically sharp extinction. The Cretaceous-Tertiary terrestrial extinction is considerably smaller in percentage of extinction than the marine extinction and is spread over 10 my of the Cretaceous and 1 my of the Tertiary. Sixty percent of the 30 dinosaurs in the northern Great Plains of the U.S. and Canada had become extinct in the 9 my before the late Maastrichtian sea level drop. The best data on the Permo-Triassic terrestrial extinction are from the Karoo basin of South Africa. This is a series of 6 extinctions in some 8 my, recorded in some 2800 meters of sediment. Precision of dating is enhanced by the high

rate of accumulation of these sediments. Few data are readily available on the timing of the marine Permo-Triassic extinction, due to the very restricted number of sequences of Tatarian marine rocks. The terminal Ordovician extinction at 438 my is relatively rapid, taking place over about 0.5 my. The most significant aspect of this extinction is a eustatic sea level lowering associated with a major episode of glaciation. New data on this extinction is the reduction from 61 genera of trilobites in North America to 14, for a 77 percent extinction. Another Ordovician extinction present over 10 percent of the North American craton occurs at 454 my in the form of a catastrophic extinction due to a volcanic eruption which blanketed the U.S. east of the Transcontinental Arch. This is the only other sizeable extinction in the Ordovician.

1527 (N–89-21287, pp. 182-183) **Impact and extinction signatures in complete Cretaceous-Tertiary (K-T) boundary sections.** Smit, J.; Groot, H.; Dejonge, R.; Smit, P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Zumaya, Caravaca and Agost sections in Spain, the El Kef section in Tunisia and the Negev (Nahal Avdat) sections in Israel are among the most continuous, expanded and complete K-T boundary sections. The distribution patterns of the planktic faunas were quantitatively analyzed in closely spaced samples across the K-T boundary in these sections, in conjuction with the geochemistry, stable isotopes, mineralogy and magnetostratigraphy. Three hundred foraminiferal specimens were randomly selected and determined. Reliable estimates for the foraminiferal productivity changes across the K-T boundary and for the 1 to 2 Ma interval preceding the K-T boundary were made from the numbers of individuals/gram of sediment corrected for the sedimentation rates (calculated from magnetic reversals and lithology). No gradual or stepwise extinction is seen below the K-T boundary nor any productivity decrease. Stable isotope analyses show a warming just after deposition of the ejecta layer, not cooling as predicted by nuclear winter scenarios, although the duration of such cooling may be too short to be observed even in these complete sections. Low REE values and cpx spherules with quench textures idential to quench-textures in diagenetically altered spherules, strongly indicate an oceanic site of (one of) the impactor(s).

1528 (N–89-21287, pp. 184-185) **Cretaceous-Tertiary boundary in the Antarctic: Climatic cooling precedes biotic crisis.** Stott, L.D.; Kennett, J.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Stable isotopic investigations were conducted on calcareous microfossils across two deep sea Cretaceous-Tertiary boundary sequences on Maud Rise, Weddell Sea, Antarctica. The boundary is taken at the level of massive extinctions in calcareous planktonic microfossils, and coincides with a sharp lithologic change from pure calcareous ooze to calcareous ooze with a large volcanic clay component. The uppermost Maestrichtian is marked by a long-term decrease in delta value of 0 to 18 which spans most of the lower and middle A. mayaroensis Zone and represents a warming trend which culminated in surface water temperatures of about 16 C. At approximately 3 meters below the K-T boundary this warming trend terminates abruptly and benthic and planktonic isotopic records exhibit a rapid increase in delta value of 0 to 18 that continues up to the K-T boundary. The trend towards cooler surface water temperatures stops abruptly at the K-T boundary and delta value of 0 to 18 values remain relatively stable through the Paleocene. Comparison of the Antarctic sequence with the previously documented deep sea records in the South Atlantic reveal shifts of similar magnitude in the latest Maestrichtian. It is indicated that the Southern Ocean underwent the most significant, and apparently permanent, climatic change. The latest Cretaceous oxygen isotopic shift recorded at Maud Rise and other deep sea sites is similar in magnitude to large positive delta valve of 0 to 18 shifts in the middle Eocene, at the Eocene/Oligocene boundary and in the middle Miocene that marked large scale climatic transitions which ultimately lead to cryospheric development of the Antarctic. The climatic shift at the end of the Cretaceous represents one of the most significant climatic transitions recorded in the latest Phanerozoic and had a profound effect on global climate as well as oceanic circulation.

1529 (N–89-21287, pp. 192-193) **Mass extinctions in the deep sea.** Thomas, E. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The character of mass extinctions can be assessed by studying extinction patterns of organisms, the fabric of the extinction, and assessing the environmental niche and mode of life of survivors. Deep-sea benthic foraminifera have been listed as little affected by the Cretaceous-Tertiary (K-T) mass extinction, but very few quantitative data are available. New data on deep-sea Late Maestrichtian-Eocene benthic foraminifera from Maud Rise (Antarctica) indicate that about 10 percent of the species living at depths of 2000 to 2500 m had last appearances within 1 my of the Cretaceous-Tertiary (K-T) boundary, versus about 25 percent of species at 1000 to 1500 m. Many survivors from the Cretaceous became extinct in a period of global deep-sea benthic foraminiferal extinction at the end of the Paleocene, a time otherwise marked by very few extinctions. Preliminary conclusions suggest that the deep oceanic environment is essentially decoupled from the shallow marine and terrestrial environment, and that even major disturbances of one of these will not greatly affect the other. This gives deep-sea benthic faunas a good opportunity to recolonize shallow environments from greater depths and vice versa after massive extinctions. The decoupling means that data on deep-sea benthic boundary was caused by the environmental effects of asteriod impact or excessive volcanism. The benthic foraminiferal data strongly suggest, however, that the environmental results were strongest at the Earth's surface, and that there was no major disturbance of the deep ocean; this pattern might result both from excessive volcanism and from an impact on land.

1530 (N–89-21287, pp. 195) **Acute effects of a large bolide impact simulated by a global atmospheric circulation model.** Thompson, S.L.; Crutzen, P.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Abstract Only.

The goal is to use a global three-dimensional atmospheric circulation model developed for studies of atmospheric effects of nuclear war to examine the time evolution of atmospheric effects from a large bolide impact. The model allows for dust and NOx injection, atmospheric transport by winds, removal by precipitation, radiative transfer effects, stratospheric ozone chemistry, and nitric acid formation and deposition on a simulated Earth having realistic geography. Researchers assume a modest 2 km-diameter impactor of the type that could have formed the 32 km-diameter impact structure found near Manson, Iowa and dated at roughly 66 Ma. Such an impact would have created on the order of 5 x 10 to the 10th power metric tons of atmospheric dust (about 0.01 g cm(-2) if spread globally) and 1 x 10 to the 37th power molecules of NO, or two orders of magnitude more stratospheric NO than might be produced in a large nuclear war. Researchers ignore potential injections of CO2 and wildfire smoke, and assume the direct heating of the atmosphere by impact ejecta on a regional scale is not large compared to absorption of solar energy by dust. Researchers assume an impact site at 45 N in the interior of present day North America.

1531 (N–89-21287, pp. 198-199) **Geochemical comparison of K-T boundaries from the Northern and Southern Hemispheres.** Tredous, M.; Verhagen, B.T.; Hart, R.J.; Dewit, C.B.; Smith, C.B.; Perch-Nielsen, K.; Sellschop, J.P.F. Lunar and Planetary Inst., Houston, TX

(USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Closely spaced (cm-scale) traverses through the K-T boundary at Stevns Klint (Denmark), Woodside Creek (New Zealand) and a new Southern Hemisphere site at Richards Bay (South Africa) were subjected to trace element and isotopic (C, O, Sr) investigation. Intercomparison between these data-sets, and correlation with the broad K-T database available in the literature, indicate that the chemistry of the boundary clays is not globally constant. Variations are more common than similarities, both of absolute concentrations, and interelement ratios. For example, the chondrite normalized platinum-group elements (PGE) patterns of Stevns Klint are not like those of Woodside Creek, with the Pt/Os ratios showing the biggest variation. These differences in PGE patterns are difficult to explain by secondary alteration of a layer that was originally chemically homogeneous, especially for elements of such dubious crustal mobility as Os and Ir. The data also show that enhanced PGE concentrations, with similar trends to those of the boundary layers, occur in the Cretaceous sediments below the actual boundary at Stevns Klint and all three the New Zealand localities. This confirms the observations of others that the geochemistry of the boundary layers apparently does not record a unique component. It is suggested that terrestrial processes, eg. an extended period of Late Cretaceous volcanism can offer a satisfactory explanation for the features of the K-T geochemical anomaly. Such models would probably be more consistent with the observed stepwise, or gradual, palaeontological changes across this boundary, than the instant catastrophe predicated by the impact theory.

1532 (N–89-21287, pp. 158-159) **Computer modeling of large asteroid impacts into continental and oceanic sites: Atmospheric, cratering, and ejecta dynamics.** Roddy, D.J.; Schuster, S.H.; Rosenblatt, M.; Grant, L.B.; Hassig, P.J.; Kreyenhagen, K.N. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Numerous impact cratering events have occurred on the Earth during the last several billion years that have seriously affected our planet and its atmosphere. The largest cratering events, which were caused by asteroids and comets with kinetic energies equivalent to tens of millions of megatons of TNT, have distributed substantial quantities of terrestrial and extraterrestrial material over much or all of the Earth. In order to study a large-scale impact event in detail, computer simulations were completed that model the passage of a 10 km-diameter asteroid through the Earth's atmosphere and the subsequent cratering and ejecta dynamics associated with impact of the asteroid into two different targets, i.e., an oceanic site and a continental site. The calcuations were designed to broadly represent giant impact events that have occurred on the Earth since its formation and specifically represent an impact cratering event proposed to have occurred at the end of Cretaceous time. Calculation of the passage of the asteroid through a U.S. Standard Atmosphere showed development of a strong bow shock that expanded radially outward. Behind the shock front was a region of highly shock compressed and intensely heated air. Behind the asteroid, rapid expansion of this shocked air created a large region of very low density that also expanded away from the impact area. Calculations of the cratering events in both the continental and oceanic targets were carried to 120 s. Despite geologic differences, impacts in both targets developed comparable dynamic flow fields, and by approx. 29 s similar-sized transient craters approx. 39 km deep and approx. 62 km across had formed. For all practical purposes, the atmosphere was nearly completely removed from the impact area for tens of seconds, i.e., air pressures were less than fractions of a bar out to ranges of over 50 km.

1533 (N–89-21287, pp. 186-187) **Some volcanologic aspects of Columbia River basalt volcanism relevant to the extinction controversy.** Swanson, D.A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The Columbia River Basalt Group is the youngest and most thoroughly studied flood-basalt province known; information about it should be relevant to questions about the possible relation of flood-basalt volcanism to mass extinctions. The group has a total volume of about 174,000 cu km and covers an area of about 164,000 sq km. It was erupted between 17.5 and 6 Ma, as measured by K-Ar and Ar-40/Ar-39 dates. Early eruptions formed the Imnaha Basalt. More than 85 percent of the group was produced during a 1.5 my period between 17 and 15.5 Ma, forming the Grande Ronde and greatly subordinate Picture Gorge Basalts. Later flows formed the Wanapum Basalt, which includes the well-known Roza Member, and the Saddle Mountains Basalt. Linear vent systems for many of the flows are known and are located only in the eastern third of the Columbia Plateau. No systematic migration of vents occurred throughout the 11.5 my period of activity; this and other considerations make it unlikely that the province is related to a hot spot. Model calculations based on observations that little cooling occurred during flow of hundreds of kilometers suggest eruption and emplacement durations of a few days. Some voluminous flows occur in all formations, but most such flows apparently were erupted during Grande Ronde time. The eruption and emplacement of more than 1,000 cu km of 1100 C basaltic lava on the surface within several days doubtless had at least local meteorologic effects. Whether the effects were broader can at present only be hypothesized. Grande Ronde Basalt and Picture Gorge Basalts contain moderately common but thin sedimentary interbeds between flows, whereas earlier and later formations contain numerous, locally thick sediment accumulations. Volcaniclastic debris derived from extra-plateau sources commonly occurs in the testbeds.

1534 (N–89-21287, pp. 206-207) **Macrofossil extinction patterns at Bay of Biscay Cretaceous-Tertiary boundary sections.** Ward, P.D.; Macleod, K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Researchers examined several K-T boundary cores at Deep Sea Drilling Project (DSDP) core repositories to document biostratigraphic ranges of inoceramid shell fragments and prisms. As in land-based sections, prisms in the deep sea cores disappear well before the K-T boundary. Ammonites show a very different extinction pattern than do the inoceramids. A minimum of seven ammonite species have been collected from the last meter of Cretaceous strata in the Bay of Biscay basin. In three of the sections there is no marked drop in either species numbers or abundance prior to the K-T boundary Cretaceous strata; at the Zumaya section, however, both species richness and abundance drop in the last 20 m of the Cretaceous, with only a single ammonite specimen recovered to date from the uppermost 12 m of Cretaceous strata in this section. Researchers conclude that inoceramid bivalves and ammonites showed two different times and patterns of extinction, at least in the Bay of Biscay region. The inoceramids disappeared gradually during the Early Maestrichtian, and survived only into the earliest Late Maestrichtian. Ammonites, on the other hand, maintained relatively high species richness throughout the Maestrichtian, and then disappeared suddenly, either coincident with, or immediately before the microfossil extinction event marking the very end of the Cretaceous.

1535 (N–89-21287, pp. 209-210) **Heavy metal toxicity as a kill mechanism in impact caused mass extinctions.** Wdowiak, T.J. (Wdowiak, P., Birmingham, AL (USA)); Davenport, S.A.; Jones, D.D.; Wdowiak, P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Heavy metals that are known to be toxic exist in carbonaceous chrondrites at abundances considerably in excess to that of the terrestrial crust. An impactor of relatively undifferentiated cosmic matter would inject into the terrestrial environment large quantities of toxic elements. The abundances of toxic metals found in the Allende CV carbonaceous chondrite and the ratio of meteoritic abundance to crustal abundance are: Cr, 3630 PPM, 30X; Co, 662 PPM, 23X; ni, 13300 PPm, 134X; se, 8.2 PPM, 164X; Os, 0.828 PPM, 166X. The resulting areal density for global dispersal of impactor derived heavy metals and their dilution with terrestrial ejecta are important factors in the determination of the significance of impactor heavy metal toxicity as a kill mechanism in impact caused mass extinctions. A 10 km-diameter asteroid having a density of 3 gram per cu cm would yield a global areal density of impact dispersed chondritic material of 3 kg per square meter. The present areal density of living matter on the terrestrial land surface is 1 kg per square meter. Dilution of impactor material with terrestrial ejecta is determined by energetics, with the mass of ejecta estimated to be in the range of 10 to 100 times that of the mass of the impactor. Because a pelagic impact would be the most likely case, the result would be a heavy metal rainout.

1536 (N–89-21287, pp. 211-212) **Cometary and asteroidal impactor flux at the earth.** Weissman, P.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The cratering records on the Earth and the lunar maria provide upper limits on the total impactor flux at the Earth's orbit over the past 600 Myr and the past 3.3 Gyr, respectively. These limits can be compared with estimates of the expected cratering rate from observed comets and asteroids in Earth-crossing orbits, corrected for observational selection effects and incompleteness, and including expected temporal variations in the impactor flux. Both estimates can also be used to calculate the probability of large impacts which may result in biological extinction events on the Earth. The estimated cratering rate on the Earth for craters greater than 10 km-diameter, based on counted craters on dated surfaces is 2.2 + or - 1.1 x 10 to the minus 14th power km(-2) yr(-1) (Shoemaker et al., 1979). Using a revised mass distribution for cometary nuclei based on the results of the spacecraft flybys of Comet Halley in 1986, and other refinements in the estimate of the cometary flux in the terrestrial planets zone, it is now estimated that long-period comets account for 11 percent of the cratering on the Earth (scaled to the estimate above), and short-period comets account for 4 pct (Weissman, 1987). However, the greatest contribution is from large but infrequent, random cometary showers, accounting for 22 pct of the terrestrial cratering.

1537 (N–89-21287, pp. 217-218) **Evidence of volcanic ash at a K-T boundary section: Ocean drilling program hole 690 C, Maud Rise, Weddell Sea off East Antarctica.** Wise, S.W.; Hamilton, N.; Pospichal, J.; Barker, P.F.; Kennett, J.P.; Oconnell, S.; Bryant, W.R.; Burckle, L.H.; Egeberg, P.K.; Futterer, D.K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Rare vitric volcanogenic ash but more abundant clay minerals considered volcanogenic in origin are associated with an expanded and essentially complete K-T boundary sequence from Ocean Drilling Project (ODP) Hole 690 C on Maud Rise in the Weddell Sea off East Antarctica. Results at this writing are preliminary and are still based to some extent on shipboard descriptions. Further shore-based studies are in progress. It would appear, however, that the presence of volcanic ash and altered ash in the Danian section beginning at the biostratigraphically and paleomagnetically determined K-T boundary on Maud Rise can be cited as evidence of significant volcanic activity within the South Atlantic-Indian Ocean sector of the Southern Ocean coincident with the time of biotic crises at the end of the Maestrichtian. This is a postulated time of tectonic and volcanic activity within this Southern Hemisphere region, including possible initiation of the Reunion hot spot and a peak in explosive volcanism on Walvis Ridge (1) among other events. A causal relationship with the biotic crisis is possible and volcanism should be given serious consideration as a testable working hypothesis to explain these extinctions.

1538 (N–89-21287, pp. 219-220) **Darkness after the K-T Impact: Effects of soot.** Wolbach, W.S.; Anders, E.; Orth, C.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

Dust from the K-T impact apparently settled from the atmosphere in less than 6 months, restoring sunlight to minimum photosynthesis levels in about 4 months. However, the discovery of a global soot component in the boundary clay makes it necessary to reconsider the problem, as soot particles not only are smaller (0.1 vs. about 0.5 micrometer) and thus settle more slowly, but also are better light absorbers optical depth of 13 mg soot cm(-2) about 1800; and are more resistant to rainout. Still, the darkness cannot have lasted very much longer than 6 months, else no larger animals would have survived. Perhaps the soot coagulated with the rock dust and fell out with it. Evidence on this point may be sought at a relatively undisturbed K-T boundary site, such as Woodside Creek, N.Z. There the boundary clay and lowermost Tertiary strata are finely laminated and show large chemical and isotopic differences on a millimeter scale, apparently representing a detailed time sequence. Researchers studied a 3 m section across the boundary at this site, analyzing the principal forms of carbon (soot, elemental C, kerogen, and carbonate) as well as 33 elements. Correlations among the elements were sought. Apparently soot came early and coagulated with the ejecta, staying with them for the primary fallout and in the next 5 cm, but then parting company, perhaps due to size sorting.

1539 (N–89-21287, pp. 221-222) **Cretaceous-Tertiary boundary marine extinction and global primary productivity collapse.** Zachos, J.C.; Arthus, M.A.; Dean, W.E. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

The extinction of marine phyto-and zoo-plankton across the K-T boundary has been well documented. Such an event may have resulted in decreased photosynthetic fixation of carbon in surface waters and a collapse of the food chain in the marine biosphere. Because the vertical and horizontal distribution of the carbon isotopic composition of total dissolved carton (TDC) in the modern ocean is controlled by the transfer of organic carbon from the surface to deep reservoirs, it follows that a major disruption of the marine biosphere would have had a major effect on the distribution of carbon isotopes in the ocean. Negative carbon isotope excursions have been identified at many marine K-T boundary sequences worldwide and are interpreted as a signal of decreased oceanic primary productivity. However, the magnitude, duration and consequences of this productivity crisis have been poorly constrained. On the basis of planktonic and benthic calcareous microfossil carbon isotope and other geochemical data from DSDP Site 577 located on the Shatsky Rise in the north-central Pacific, as well as other sites, researchers have been able to provide a reasonable estimate of the duration and magnitude of this event.

1540 (N–89-21287, pp. 223-224) **Impact production of NO and reduced species.** Zahnle, K.; Kasting, J.; Sleep, N. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183329;NAS–1.26:183329;LPI-CONTRIB–673;CONF-8810341–: Global catastrophes conference, Snowbird, UT (USA), 20-23 Oct 1988). In *Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality.* Available from NTIS, PC A11/MF A01.

It has recently been suggested that a reported spike in seawater (87)Sr/(86)Sr at the K-T boundary is the signature of an impact-generated acid deluge. However, the amount of acid required is implausibly large. Some about 3 x 10 to the 15th power moles of Sr must be weathered from silicates to produce the inferred Sr spike. The amount of acid required is at least 100 and probably 1000 times greater. Production of 3 x 10 to the 18th power moles of NO is clearly untenable. The atmosphere presently contains only 1.4 x 10 to the 20th power moles of N_2 and 3.8 x 10 to the 19th power moles of O sub 2 If the entire atmosphere were shocked to 2000 K and cooled within a second, the total NO produced would be about 3 x 10 to the 18th power moles. This is obviously unrealistic. A (still to short) cooling time of 10th to the 3rd power sec reduces NO production by an order of magnitude. In passing, we note that if the entire atmosphere had in fact been shocked to 2000 K, acid rain would have been the least of a dinosaur's problems. Acid rain as a mechanism poses other difficulties. Recently deposited carbonates would have been most susceptable to acid attack. The researchers' preferred explanation is simply increased continental erosion following ecological trauma, coupled with enchanced levels of CO_2.

5802 Geophysics

Refer also to citation(s) 236, 484, 496, 506, 895, 1233, 1320

1541 (AD-A–209803/6/XAB) **Boundary-layer dynamics in the description of magnetospheric substorms.** Eastman, T.E.; Rostoker, G.; Frank, L.A.; Huang, C.Y.; Mitchell, D.G. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. 1988. 23p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysics Research, Vol. 93, No. A12, 411-432(1988). Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Magnetospheric substorm activity has been previously explained primarily as the effects of the episodic unloading of energy stored in the Earth's magnetotail. The physics of the unloading process has been associated with magnetic field-line reconnection. The near-Earth neutral line model seeks to explain plasma and field characteristics observed in the magnetotail by the development and ultimate disappearance downtail of a plasmoid involving the population of the plasma sheet anti-earthward of the near-Earth neutral line. This reprint presents a study of a significant number of substorm expansive phase events where the phenomenology at ionospheric levels is clearly defined in terms of onset time and locale of the substorm disturbed region. Through the detailed presentation of a subset of these events is demonstrated that the magnetotail particle and field observations associated with a substorm expansive phase can equally well be explained through the spatial movement of the boundary layers and central plasma sheet in the magnetotail. The sweeping of these regions past the satellite, even in the absence of temporal variations within the various regions, can lead to a set of plasma flow observations typical of what is observed in the magnetotail during substorm activity. Filamentary currents in the plasma-sheet boundary layer can produce the magnetic field signatures presently attributed to retreating plasmoids in the magnetotail. The major strength of this emphasis on boundary-layer dynamics is that it provides a framework which naturally encompasses both the driven system and loading-unloading system which are recognized to be operative simultaneously during magnetospheric substorm activity.

1542 (AD-A–209981/0/XAB) **Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988.** Harjes, H.P. Ruhr-Univ., Bochum (Germany, F.R.). Fakultaet fuer Geowissenschaften. 15 Feb 1989. 95p. (RUB–89-100). Available from NTIS, PC A05/MF A01.

The project is aiming at a siting survey for an advanced seismic array in the Federal Republic of Germany which could be used in a multi-array network jointly with arrays in Scandinavia to detect and identify seismic events especially at regional distances. In order to assess the eventual capabilities of a new high-frequency array in the FRG, it was necessary to conduct a noise survey and to evaluate signal characteristics, both in the high-frequency band up to 50 Hz. It was found that the Bavarian Forest (BF) in the southeastern part of the FRG at the border to Austria and Czechoslovakia is principally suited for such an array installation.

1543 (EGG-BEG–8665) **The 1988 INEL [Idaho National Engineering Laboratory] microearthquake survey near the western edge of the eastern Snake River Plain.** Jackson, S.M.; Anderson, D.M.; Carpenter, G.S.; Gilbert, H.K.; Martin, S.M.; Permann, P.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 54p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002022. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A network of seventeen analog recording seismograph, spaced approximately 2 km apart, were operated from May to November, 1988 near the western edge of the eastern Snake River Plain (ESRP) to record small magnitude microearthquakes. Two three-component digital seismographs were also installed to record the microearthquake activity for analysis of earthquake source parameters and any regional earthquakes for possible analysis of the localized site and crustal effects of the ESRP on earthquake ground motions. We determined near-surface crustal velocities for this area that were slightly lower than the near-surface crustal velocities presently used in routine locations of events recorded by the INEL Seismic Network from five 100 lb surface blasts. During the survey period, only two earthquakes were located near the network area. One of the events occurred in May and was recorded by four of the portable seismic stations and two of the permanent INEL Seismic Network stations. It had a coda magnitude (M_c) of approximately 0.3. The other event was recorded by seventeen portable analog stations and three of the permanent INEL Seismic Network stations. We located this microearthquake, M_c=0.5, about 2 km west of Howe, Idaho, off of the ESRP. We determined an unconstrained focal mechanism for this event, which could be interpreted as normal faulting striking N 44° W or strike-slip faulting on a plane striking either N 44° W or N 47° E. 26 refs., 10 figs., 3 tabs.

5803 Mineralogy, Petrology, and Rock Mechanics

Refer also to citation(s) 161, 308, 1546

5804 Geochemistry

Refer also to citation(s) 162

1544 (UCRL–98727) **Activity coefficients in aqueous salt solutions: 2, Hydration theory equations.** Wolery, T.J.; Jackson, K.J. Lawrence Livermore National Lab., CA (USA). 1 Aug 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8809239–2: Symposium on chemical modeling in aqueous systems II, Los Angeles, CA (USA), 25-30 Sep 1988). Order Number DE90001143. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new set of phenomenological equations for describing the activity coefficients of aqueous electrolytes has been derived, based on the hydration theory concept of Stokes and Robinson, but using the "differentiate down" approach in which an expression is first defined for the excess Gibbs energy. Separate equations are given for the activity of water and the activity coefficients of ionic solutes. The new equations incorporate an empirical but thermodynamically consistent scheme for using an average ion size parameter in the Debye-Hueckel part of the model. This permits the new equations to be applied to mixtures of aqueous electrolytes. The new equations, applied to the case of a pure aqueous electrolyte, do not reduce to the familiar Stokes-Robinson equation owing to a minor difference in how the Debye-Hueckel model is presumed to apply to formally hydrated solutes. As a first step in evaluating the usefulness of the equations, we have fit a "two-parameter" (ion size plus hydration number) model to data for a number of pure aqueous electrolytes. The quality of the fits is excellent in many cases, but there are indications that more satisfactory results would be obtained by fixing reasonable values for the ion sizes and compensating for the loss of a fitting parameter by including ion pairs in the models, by including virial coefficient terms in the equations, or both. 17 refs., 3 figs., 1 tab.

1545 (ZfK–584, pp. 82) **Rare earth element and yttrium contents in fluorite samples.** Degering, D. (Bergakademie, Freiberg (German Democratic Republic). Sektion Physik); Untericker, S.; Stolz, W.; Leeder, O.; Wendebaum, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. CERIUM/activation analysis; DYSPROSIUM/activation analysis; EUROPIUM/activation analysis; FLUORITE/chemical composition; FLUORITE/activation analysis; LANTHANUM/activation analysis; SAMARIUM/activation analysis; TERBIUM/activation analysis; YTTERBIUM/activation analysis; YTTRIUM/activation analysis; ATOMIC RADII; CERIUM; COMPARATIVE EVALUATIONS; DYSPROSIUM; ELEMENT ABUNDANCE; EUROPIUM; FLUORITE; GEOCHEMISTRY; GEOLOGIC DEPOSITS; LANTHANUM; NEUTRONS; SAMARIUM; TERBIUM; YTTERBIUM; YTTRIUM

1546 **Crystal defects and the dissolution kinetics of rutile.** Casey, W.H. (Sandia National, Albuquerque, NM (USA)); Carr, M.J.; Graham, R.A. *Geochimica et Cosmochimica Acta (USA),* 52(6): 1545-1556 (Jun 1988). DOE Contract AC04-76DP00789.

The dissolution rate of rutile in hydrofluoric acid was measured to examine the importance of line and point defects on the reaction rate. In spite of this large variation in dislocations and point defect concentrations, the authors observed only a factor of two variation in the reaction rate for shocked and annealed material. Existing theories suggest that etch pits nucleate and grow at the outcrop of a dislocation on the crystal surface. Assuming that the measured dislocation densities can be used to estimate the density of surface outcrops, and that each outcrop dissolves to form an etch pit, the relation between dissolution rates and dislocations can be interpreted in terms of a mean rate of etch pit growth. The mean rate of etch pit growth in shocked samples is less than 9×10^{-27} cm^3 s^{-1}. In experiments with single rutile crystals, however, observable etch pits grow at rates on the order of 1×10^{-19} cm^3 s^{-1}. This discrepancy suggests either that: (i) the observed etch pits grow much more rapidly than the mean rate; of (ii) bulk dislocation density is not a useful measure of potential sites for etch pit growth on rutile crystal surfaces.

64 PHYSICS I

6401 Astrophysics and Cosmology

Refer also to citation(s) 1726, 1766

1547 (AD-A–205194/4/XAB) **Scientific background and design specifications for a near-earth heliospheric imager. Final report, 1 March 1985-30 September 1987.** Jackson, B.V. California Univ., San Diego, La Jolla, CA (USA). Dept. of Electrical Engineering and Computer Sciences. 9 Aug 1988. 19p. Available from NTIS, PC A03/MF A01.

This report is intended to define the instrument specifications for a heliospheric imager capable of observing transient, diffuse features in the heliosphere from a spacecraft near 1 AU. These features include coronal mass ejections, co-rotating density enhancements, shock waves, and any other disturbances that can affect the intensity of the electron-scattering coronal brightness. The technique of imaging a large portion of the heliosphere using the HELIOS spacecraft zodiacal-light photometers has shown that it is possible to measure the structures around a spacecraft and to make good measurements of material in and out of the ecliptic plane. The HELIOS data show that it is possible to determine the velocities and spatial distributions of the large-scale features which propagate into the heliosphere. The instrumentation may be regarded as a successor to the zodiacal-light photometers of the HELIOS spacecraft. Such a second-generation instrument based on these principals could make effective use of in-situ solar-wind data from spacecraft in the vicinity of the imager, and would allow study of the effects of heliospheric structure interaction with the magnetosphere as never before possible. In addition, the imager would allow up to three days warning of the arrival of a mass ejection at Earth from the Sun.

1548 (AD-A–210109/5/XAB) **Studies of the cosmic ray penumbra. Final report, 9 September 1980-30 September 1985.** Cooke, D.J. Utah Univ., Salt Lake City, UT (USA). Dept. of Physics. 11 Aug 1988. 110p. Available from NTIS, PC A06/MF A01.

The penumbra is the term used to refer to the interval of space which lies, for any given particle rigidity, between the solid-angle zone within which all such particles have free access, and the region within which particle access is completely forbidden. The term is also used to refer, in a specific direction, to the rigidity interval between the lowest rigidity for which any particle may enter in the given direction, and the rigidity below which particle access is completely forbidden in the same direction. Typically, the penumbra consists of a mixture of allowed and forbidden trajectories. This question of access of charged primary cosmic rays to points within the magnetic field of a plant is of great interest in numbers of areas of physics. It is very difficult, however, to map the allowed and forbidden regions of access, because of the time-consuming nature of the calculations involved. This research has involved a systematic study of the nature of the characteristic zones of access in order to produce techniques by which information about the cosmic-ray penumbra may efficiently be derived. The work has then focused on the mapping and study of the phenomenology of the penumbra.

1549 (ESA-SP–285-VOL-1, pp. 197-201) **The case for a primordial galactic field.** Kulsrud, R. European Space Agency, 75 - Paris (France). Jan 1989. (ETN–89-94475;CONF-8809173–: International workshop on reconnection in space plasma, Potsdam (German Democratic Republic), 5-9 Sep 1988). In *Proceedings of an International School and Workshop on Plasma Astrophysics, volume 1.* Available from NTIS, PC A18/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 45 US dollars or 80 Dutch guilders.

Two theories of the origin of the galactic magnetic field are discussed. It is shown that the first theory, of its generation by a fast magnetic dynamo, is limited by the properties of the interstellar medium which suppress the small scale motions in the turbulence, and thus inhibit the generation of the field from a small seed field. The second theory that the galactic field is a relic of a general cosmic magnetic field existing prior to formation of our galaxy is discussed. It is pointed out that such a field would evolve to a field very similar to that which we see today.

1550 (ESA-SP–286, pp. 3-10) **The excitation and damping of solar oscillations.** Libbrecht, K.G. European Space Agency, 75 - Paris (France). Dec 1988. (ETN–89-94449;CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz (Spain), 26 Sep - 1 oct 1988). In *Seismology of the Sun and Sun-Like Stars.* Available from NTIS, PC A99/MF E03.

The status of understanding of the excitation and damping of solar p-mode oscillations is reviewed. While a few simple statements can be made about the expected properties of p-modes, there is currently no complete theory which explains the observed mode amplitudes and linewidths. Evidence suggests that the p-modes cannot be overstable and therefore self-excited, but are instead probably stochastically excited by turbulent convection. The status of the latter model for exciting p-modes, and possible future directions are discussed.

1551 (ESA-SP–286, pp. 21-26) **Nonlinear studies of solar gravity modes driven by nuclear burning of He3 in the core.** Merryfield, W.J. (Cambridge Univ. (England)); Toomre, J.; Gough, D.O. European Space Agency, 75 - Paris (France). Dec 1988. (ETN–89-94449;CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz (Spain), 26 Sep - 1 oct 1988). In *Seismology of the Sun and Sun-Like Stars.* Available from NTIS, PC A99/MF E03.

The finite-amplitude behavior of gravity-mode oscillations driven within the deep interior of the Sun was studied by means of a simple idealized model. Such g modes may be self-excited by their ability to extract energy from the nuclear burning of He3 in the core. Both a nonlinear bifurcation analysis and numerical simulations of the behavior of this instability suggest that the growth of He3-driven

oscillations is likely to be limited to an amplitude which is insufficient to induce convective instability in the core, a process proposed as a mechanism for core mixing. The numerical results also indicate that if the oscillations are linearly unstable then the degeneracy in linear theory between standing and travelling g modes is broken by nonlinear effects. The oscillations thus develop into a left- or right-travelling wave rather than a standing wave or other superposition of horizontally propagating waves.

1552 (ESA-SP–286, pp. 399-401) **Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies.** Gu, Yeming; Hill, H.A.; Rosenwald, R.D. European Space Agency, 75 - Paris (France). Dec 1988. (ETN–89-94449;CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz (Spain), 26 Sep - 1 oct 1988). In *Seismology of the Sun and Sun-Like Stars*. Available from NTIS, PC A99/MF E03.

The asymptotic properties of the low-degree solar gravity modes classified by Hill and Gu (1988) are studied in the framework of first- and second-order asymptotic theory predictions. The results demonstrate the necessity of retaining the second-order term in asymptotic theory to describe the eigenfrequency spectrum. In this theory, there are two first-order parameters, T0 and delta, and two second-order parameters, V1 and V2. Values of the parameters obtained in this analysis are: T0 = 36.31 + or - 0.12 min, delta = -043 + or - 0.13, V1 = 0.35, and V2 = 4.76. There remain differences of 0.3 micro Hz between the asymptotic theory eigenfrequencies and observed eigenfrequencies which are quasi-periodic functions of the radial order n for a given value of the degree l.

1553 (ESA-SP–286, pp. 595-600) **Solar oscillations instrumentation and measurement theory.** Appourchaux, T. European Space Agency, 75 - Paris (France). Dec 1988. (ETN–89-94449;CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz (Spain), 26 Sep - 1 oct 1988). In *Seismology of the Sun and Sun-Like Stars*. Available from NTIS, PC A99/MF E03.

Solar-oscillation instruments are reviewed. Common characteristics include detecting solar radial velocities on Fraunhofer lines with a 2-point measuring technique, high spectral resolution and stability, etc. The choice of the spectral line for getting a high signal to solar noise ratio is addressed. Velocity imaging of solar oscillations modes is detailed, including spatial sampling and span, highest observable degree. Applications of these different analyses is applied to existing or future helioseismology instruments.

1554 (INIS-BR–1624) **Proceedings of the 1. Latin-American Conference on Space Geophysics.** Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. 151p. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Studies on: magnetic storms and particle densities, trapping, and kinetics in the atmosphere and geomagnetic field; cosmic ray interactions with atmosphere and geomagnetic field; sunspots and solar prominences; disturbances, wind, radio bursts, magnetic fields, structure and spectra of the sun; interplanetary magnetic fields and; radio emissions from planets; are presented. (M.C.K.).

1555 (INIS-BR–1624, pp. 18) **Solar interplanetary coupling.** Machado, M.A.E. (Argentina). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SOLAR FLARES/interplanetary space; SOLAR PROMINENCES/interplanetary space; MAGNETIC FIELDS; PLASMA; SOLAR CORONA

1556 (INIS-BR–1624, pp. 49) **Correlative analyses for geomagnetic indices, cosmic-ray intensities and sunspot numbers recorded since 1937.** Storini, M. (Consiglio Nazionale delle Ricerche, Rome (Italy). Raggi Cosmici - I.F.S.I.); Filinetti, O.B.; Mussino, V.; Parisi, M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GEOMAGNETIC FIELD/cosmic radiation; GEOMAGNETIC FIELD/sunspots; INTERPLANETARY SPACE/cosmic radiation; INTERPLANETARY SPACE/geomagnetic field; GALAXIES; SUNSPOTS; HELIOSPHERE

1557 (INIS-BR–1624, pp. 91) **Experimental study of atmospheric gases by electron impact technique.** Robert, H.M.B. (5529365BR); Bielschowsly, C.A.; Souza, G.G.B.; Lucas, C.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MARS PLANET/planetary atmospheres; VENUS PLANET/planetary atmospheres; ARGON; DIFFERENTIAL CROSS SECTIONS; ELECTRON COLLISIONS; ELECTRON SPECTROMETERS; EXCITATION; OSCILLATOR STRENGTHS

1558 (INIS-BR–1624, pp. 99) **Preliminary results of recent centimetre wavelength radio observation of Mercury, Venus, Mars, Jupiter and Saturn.** Scalise Junior, E.; Ciampo, L.J. del. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. PLANETS/cosmic ray detection; PLANETS/solar system; RADIOWAVE RADIATION/planets; RADIOWAVE RADIATION/wavelengths; PLANETS; WAVELENGTHS; TEMPERATURE MEASUREMENT

1559 (INIS-BR–1624, pp. 108) **Coronal heating with surface waves.** Assis, A.S. de (Universidade Federal Fluminense, Niteroi, RJ (Brazil)). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. PHOTOSPHERE/alfven waves; PHOTOSPHERE/heating; ENERGY CONVERSION; KINETIC ENERGY; PHOTOSPHERE; HEATING

1560 (INIS-BR–1624, pp. 109) **Global Alfiven modes in solar physics preliminary studies.** Azevedo, C.A. (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Assis, A.S. de. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SOLAR PROMINENCES/solar corona; SOLAR PROMINENCES/wave propagation; ALFVEN WAVES; FREQUENCY DEPENDENCE; HEATING; MAGNETIC FIELDS

1561 (INIS-BR–1624, pp. 111) **Generation mechanism of type III radio emission in the solar wind.** Chian, A.C.-L. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics*. Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SOLAR RADIO BURSTS/solar wind; TWO-STREAM INSTABILITY/solar wind; LANGMUIR FREQUENCY

1562 (INIS-BR–1624, pp. 114) **Solar activity and EL nino.** Perez-Enriquez, R.; Mendoza, B.; Alvarez-Madrigal, M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. RIVERS/seas; SOLAR ACTIVITY/rivers; RIVERS; SEAS; SUNSPOTS

1563 (INIS-BR–1624, pp. 118-119) **Energy cancellation and emission in solar atmosphere.** Livi, S.H.B. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (In Portuguese). (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. PHOTOSPHERE/emission; PHOTOSPHERE/solar energy; MAGNETIC FIELDS; PHOTOSPHERE; EMISSION; SOLAR FLARES

1564 (INIS-BR–1624, pp. 120) **Solar wind streams, magnetospheric substorms and El Nino.** Mendoza, B. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Geofisica); Perez-Enriquez, R.; Alvarez-Madrigal, M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/earth magnetosphere; MAGNETIC STORMS/solar wind; RIVERS/seas; RIVERS/solar wind; CORRELATIONS; RIVERS; SEAS

1565 (INIS-BR–1624, pp. 125) **Two forecasts for investigation of generation mechanism of sunspots.** Rosa, R. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Observatorio do Valongo); Gonzalez, E.A.M.; Roberty, H.B. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SUNSPOTS/magnetic fields; SUNSPOTS/mathematical models; BOUNDARY CONDITIONS; SOLAR CYCLE; SUNSPOTS

1566 (INIS-BR–1624, pp. 126) **MM. wavelength spectroscopic observations of solar activity region.** Sawant, H.S.; Cecatto, J.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SOLAR ACTIVITY/spectroscopy; SOLAR ACTIVITY/wavelengths; BREMSSTRAHLUNG; FREQUENCY RANGE; SPECTROSCOPY; WAVELENGTHS

1567 (INIS-BR–1624, pp. 121) **Effects of corotation electric field on the dynamic of energetic particles in an asymetric planetary magnetic field.** Pinto Junior, O.; Gonzalez, W.D.; Pinto, I.R.C.A.; Mendes Junior, O. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. CHARGED-PARTICLE PRECIPITATION/dynamics; EARTH MAGNETOSPHERE/charged-particle precipitation; PLANETARY MAGNETOSPHERES/charged-particle precipitation; ASYMMETRY; DYNAMICS; ELECTRIC FIELDS; KEV RANGE 10-100; KEV RANGE 100-1000; MAGNETIC FIELDS

1568 (LA-UR–89-3124) **Dark matter and the solar neutrino problem: Can particle physics provide a single solution.** West, G.B. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90001827. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We show how a relatively simple extension of the standard model can give a "natural" explanation for both the solar neutrino and dark matter problems. What is required is a new stable neutral lepton with a mass in the 4–8 GeV range. One possibility is a fourth generation neutrino interacting with matter either electromagnetically or via higgs-exchange (in addition, of course, to Z°-exchange). In the former case, a new charged lepton with mass ~10GeV would be required in order to generate a sufficiently large magnetic moment. The present experimental situation makes this possibility rather doubtful. In the latter case, a light higgs with mass ~1GeV is required; this is still not ruled out experimentally. In any case, direct (or indirect) detection of dark matter will, during the next year, seal the fate of this model. 29 refs.

1569 (LA-UR–89-3310) **A source of observational constraints on the structure of Wolf-Rayet winds.** Auer, L.H.; Koenigsberger, G. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908167–1: Hot stars workshop, Boulder, CO (USA), 6-11 Aug 1989). Order Number DE90001236. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In some WR + O-star binary systems the WR wind eclipses the O star. The profile changes as function of impact are reproduced with a simple model which gives information on both the radial dependence of the velocity and opacity. 2 refs.

1570 (N–89-17540) **Great attractor really a great wall.** Stebbins, A.; Turner, M.S. California Univ., Santa Barbara, CA (USA). Nov 1988. 8p. (NASA-CR–184772;NAS–1.26:184772;FERMILAB-PUB–88/170-A). Available from NTIS, PC A02/MF A01.

Some of the cosmological consequences are discussed of a late time phase transition which produces light domain walls. The observed peculiar velocity field of the Universe and the observed isotropy of the microwave background radiation severely constrain the wall surface density in such a scenario. The most interesting consequence of such a phase transition is the possibility that the local, coherent streaming motion reported by the Seven Samurai could be explained by the repulsive effect of a relic domain wall with the Hubble volume (the Great Wall).

1571 (N–89-17558) **Ideal black hole fluid.** Smalley, L.L. National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center. Jan 1989. 12p. (NASA-TM–100349;NAS–1.15:100349). Available from NTIS, PC A03/MF A01.

The concept of a primordial black hole fluid is introduced and its consequence for supercluster-sized (i.e., large scale) voids and the missing mass question are discussed.

1572 (N–89-18276) **Distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter dominated universe.** Ryu, D.; Vishniac, E.T.; Chiang, W.H. Texas Univ., Austin, TX (USA). Nov 1988. 46p. (NASA-CR–181450;NAS–1.26:181450;FERMILAB-PUBL–88/187-A). Available from NTIS, PC A03/MF A01.

The evolution and distribution of galaxies and the intergalactic medium (IGM) have been studied, along with collisionless dark matter in a Universe dominated by cold dark matter. The Einstein-deSitter universe with omega sub 0 = 1 and h = 0.5 was considered (here h = H sub 0 bar 100/kms/Mpc and H sub 0 is the present value of the Hubble constant). It is assumed that initially dark matter composes 90 pct and baryonic matter composes 10 pct of total mass, and that the primordial baryonic matter is comprised of H and He, with the abundance of He equal to 10 pct of H by number. Galaxies are allowed to form out of the IGM, if the total density and baryonic density satisfy an overdensity criterion. Subsequently, the newly formed galaxies release 10 to the 60th ergs of energy into

the IGM over a period of 10 to the 8th years. Calculations have been performed with 32 to the 3rd dark matter particles and 32 to the 3rd cells in a cube with comoving side length L = 9.6/h Mpc. Dark matter particles and galaxies have been followed with an N-body code, while the IGM has been followed with a fluid code.

1573 (N–89-18288, pp. 61) **Martian regolith geochemistry and sampling techniques.** Clark, B.C. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

Laboratory study of samples of the intermediate and fine-grained regolith, including duricrust peds, is a fundamental prerequisite for understanding the types of physical and chemical weathering processes on Mars. The extraordinary importance of such samples is their relevance to understanding past changes in climate, availability (and possible physical state) of water, eolian forces, the thermal and chemical influences of volcanic and impact processes, and the inventory and fates of Martian volatiles. Fortunately, this regolith material appears to be ubiquitous over the Martian surface, and should be available at many different landing sites. Viking data has been interpreted to indicate a smectite-rich regolith material, implying extensive weathering involving aqueous activity and geochemical alteration. An all-igneous source of the Martian fines has also been proposed. The X-ray fluorescence measurement data set can now be fully explained in terms of a simple two-component model. The first component is silicate, having strong geochemical similarities with Shergottites, but not other SNC meteorites. The second component is salt. Variations in these components could produce silicate and salt-rich beds, the latter being of high potential importance for microenvironments in which liquid water (brines) could exist. It therefore would be desirable to scan the surface of the regolith for such prospects.

1574 (N–89-18288, pp. 63-64) **Glass: a source of data leading to constraints on the volcanic, impact, and atmospheric histories of Mars.** Delano, J.W. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

Volcanism and impact are important processes on Mars. Both mechanisms can produce glasses. Criteria exist for distinguishing between impact glasses and volcanic glasses. Owing to the single-phase nature of glass, tiny pieces (approximately 50-micrometer diameter) are as compositionally representative as larger pieces, in contrast to multi-phase crystalline samples, such as basalts. The thesis of this abstract is that glasses may be common in the Martian regolith and should be a high-priority sample owing to their combination of: (1) low representative mass, and (2) high content of information.

1575 (N–89-18375) **Investigation of ground-based observations of solar oscillations at Stanford.** Henning, H.M.J. Stanford Univ., CA (USA). Dec 1987. 225p. (NASA-CR–184763;NAS–1.26:184763;SU-CSSA-ASTRO–87-21). Available from NTIS, PC A10/MF A01.

Data obtained in the last 8 years of solar differential Doppler observations at Stanford were considered. The four best time series of data were examined in detail. The sources of error in the data were investigated and removed where possible. In particular, the contribution resulting from transparency variations in the sky was examined. Detection method applicable to data with low signal to noise ratio and low filling factor were developed and utilized for the investigation of global solar modes of oscillations in the data. The frequencies of p-modes were measured and identified. The presence of g-modes were also determined in the Stanford data.

1576 (N–89-18376) **Solar g-mode oscillations: Comparison of SMM-ACRIM and ground-based observations. Final report, 1 July 1987-30 June 1988.** Scherrer, P.H. Stanford Univ., CA (USA). Feb 1989. 6p. (NASA-CR–184762;NAS–1.26:184762;SU-SPO–4672). Available from NTIS, PC A02/MF A01.

Progress was made in access to data and in developing programs for its analysis. The difficulties in completing the work in the planned time can be traced to several factors. The correction of the Stanford oscillation using gridded intensity data was not successful. It was concluded that due to poor continuity of the 1985 and 1986 data due to clouds, that a joint analysis with the ACRIM data (best solar oscillation data to date) on the summer 1987 observations should be performed. The 1988 Stanford oscillation data are being examined and the cross comparison of the ACRIM spectrum with the Standford spectrum for 1987 in the g-mode regime will shortly begin.

1577 (N–89-24240) **Comet Halley: The view from Pioneer Venus.** National Aeronautics and Space Administration, Washington, DC (USA). 1989. 8p. (NASA-NF–127;NAS–1.20:127). Available from NTIS, PC A02/MF A01.

Original contains color illustrations.

The plans to scan Halley's Comet at close range using the Pioneer Venus Orbiter are discussed. The composition of comets, their paths through space, and the history of comet encounters are examined. An ultraviolet spectrometer aboard the spacecraft will determine the composition of the gaseous coma and will measure the total gas production during its passage. The Pioneer Venus Orbiter will observe the comet for five weeks before solar interference with communications occurs as Venus passes on the far side of the Sun from Earth. Diagrams of the solar system and the relationship of the comet to the planets and the Sun are provided.

1578 (N–89-25099) **Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990.** Guberman, S.L. Institute for Scientific Research, Lexington, MA (USA); Institute for Scientific Research, Lexington, MA (USA). Apr 1989. 30p. (NASA-CR–184951;NAS–1.26:184951). Available from NTIS, PC A03/MF A01.

Current efforts have focused on the dissociative recombination (DR) of O2(+), a process of great importance in planetary atmospheres. This process is difficult to study experimentally because of the need to determine the dependence of the product electronic states and kinetic energies upon the vibrational distribution of the ion and electron temperature. The knowledge of these characteristics of DR is needed to accurately model planetary ionospheres. Using a theoretical quantum chemical approach, the generation of O(1S) from DR was studied in detail.

1579 (N–89-25541) **Wave emissions from planetary magnetospheres. Final report, 1 June 1985-31 May 1989.** Grabbe, C.L. Iowa Univ., Iowa City, IA (USA). Mar 1989. 68p. (NASA-CR–185435;NAS–1.26:185435). Available from NTIS, PC A04/MF A01.

An important development in the Earth magnetosphere was the discovery of the boundary of the plasma sheet and its apparent role in the dynamics of the magnetotails. Three instabilities (negative energy mode, counterstreaming, and the Buneman instability) were investigated through analytical and numerical studies of their frequency and growth rate as a function of the angle of propagation.

1580 (N–89-25678) **Solitosynthesis: Cosmological evolution of non-topological solitons.** Griest, K.; Kolb, E.W. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 32p. (NASA-CR–185030;NAS–1.26:185030;FERMILAB-PUB–89/83-A). Available from NTIS, PC A03/MF A01.

The thermal creation, fusion, evaporation, and destruction of non-topological solitons (NTS) after a phase transition in the early universe is considered. By defining and following NTS statistical equilibrium and departures from it, and depending on particle physics parameters, one of three possible scenarios occurs. If reaction rates are high enough, a period of equilibrium occurs and relic abundances are determined by the freeze-out temperature. Equilibrium first drives most NTS's into their constituents (free phi particles) and then causes rapid fusion into large NTS's. If freeze-out occurs during the first phase, the NTS's are almost entirely destroyed, while if it occurs during the second phase, solitosynthesis occurs and NTS's may be cosmically relevant. For slow reaction rates the NTS's are born frozen out and have the abundance

determined by the phase transition. Analytic approximations for determining the abundances are developed, and tested by numerically integrating a reaction network in an expanding universe. Unfortunately, for most of the parameter space considered, solito-destruction/evaporation occurs.

1581 (N–89-25680) **Statistical fluctuations as the origin of nontopological solitons.** Griest, K.; Kolb, E.W.; Masarotti, A. Fermi National Accelerator Lab., Batavia, IL (USA). Apr 1989. 13p. (NASA-CR–185351;NAS–1.26:185351;FERMILAB-PUB–89/110-A). Available from NTIS, PC A03/MF A01.

Nontopological solitons can be formed during a phase transition in the early universe as long as some net charge can be trapped in regions of false vacuum. It has been previously suggested that a particle-antiparticle asymmetry would provide a source for such trapped charge. It is pointed out that, for the model and parameters considered, statistical fluctuations provide a much larger concentration of charge, and are therefore, the dominant source of charge fluctuations in solitogenesis.

1582 (N–89-25777) **Neutron stars: A cosmic hadron physics laboratory.** Pines, D. Illinois Univ., Urbana, IL (USA). 1989. 23p. (NASA-CR–185051;NAS–1.26:185051). Available from NTIS, PC A03/MF A01.

A progress report is given on neutron stars as a cosmic hadron physics laboratory. Particular attention is paid to the crustal neutron superfluid, and to the information concerning its properties which may be deduced from observations of pulsar glitches and postglitch behavior. Current observational evidence concerning the softness or stiffness of the high density neutron matter equation of state is reviewed briefly, and the (revolutionary) implications of a confirmation of the existence of a 0.5 ms pulsar at the core of (Supernova) SN1987A are discussed.

1583 (N–89-25780) **The origin of ultra-compact binaries.** Hachisu, Izumi; Miyaji, Shigeki; Saio, Hideyuki. National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center. 1987. 43p. (NASA-TM–101792;NAS–1.15:101792). Available from NTIS, PC A03/MF A01.

The origin of ultra-compact binaries composed of a neutron star and a low-mass (about 0.06 solar mass) white dwarf is considered. Taking account of the systemic losses of mass and angular momentum, it was found that a serious difficulty exists in the scenarios which involve tidal captures of a normal star (a main sequence star or a red giant) by a neutron star. This difficulty can be avoided if a red giant star is captured by a massive white dwarf (M is approx. greater than 1.2 solar masses), which becomes a neutron star through the accretion induced collapse.

1584 (N–89-25945) **The evolution of energetic particles and the emitted radiation in solar flares. Ph.D. Thesis.** Lu, E.T. Stanford Univ., CA (USA). Jun 1989. 126p. (NASA-CR–185389;NAS–1.26:185389;CSSA-ASTRO–89-08). Available from NTIS, PC A07/MF A01.

The evolution of accelerated particle distributions in a magnetized plasma and the resulting radiation are calculated, and the results are applied to solar flares. To study the radiation on timescales of order the particle lifetimes, the evolution of the particle distribution is determined by the use of the Fokker-Planck equation including Coulomb collisions and magnetic mirroring. Analytic solution to the equations are obtained for limiting cases such as homogeneous injection in a homogeneous plasma, and for small pitch angle. These analytic solutions are then used to place constraints on flare parameters such as density, loop length, and the injection timescale for very short implusive solar flares. For general particle distributions in arbitrary magnetic field and background density, the equation is solved numerically. The relative timing of microwaves and X-rays during individual flares is investigated. A number of possible sources for excessive microwave flux are discussed including a flattening in the electron spectrum above hard X-ray energies, thermal synchrotron emission, and trapping of electron by converging magnetic fields. Over shorter timescales, the Fokker-Planck equation is solved numerically to calculate the temporal evolution of microwaves and X-rays from nonthermal thick target models. It is shown that magnetic trapping will not account for the observed correlation of microwaves of approximately 0.15 seconds behind X-rays in flares with rapid time variation, and thus higher energy electrons must be accelerated later than lower energy electrons.

1585 (N–89-26300) **The delineation and interpretation of the earth's gravity field. Annual progress report, 1 June 1988-31 May 1989.** Marsh, B.D. Johns Hopkins Univ., Baltimore, MD (USA). May 1989. 24p. (NASA-CR–185333;NAS–1.26:185333). Available from NTIS, PC A03/MF A01.

In an attempt to understand the mechanical interaction of a growing lithosphere containing fracture zones with small and large scale mantle convection, which gives rise to geoid anomalies in oceanic regions, a series of fluid dynamical experiments is in progress to investigate: (1) the influence of lithosphere structure, fluid depth and viscosity field on the onset, scale, and evolution of sublithospheric convection; (2) the role of this convection in determining the rate of growth of lithosphere, especially in light of the flattening of the lithosphere bathymetry and heat flow at late times; and (3) combining the results of both numerical and laboratory experiments to decide the dominate factors in producing geoid anomalies in oceanic regions through the thermo-mechanical interaction of the lithosphere and subjacent mantle. The clear existence of small scale convection associated with a downward propagating solidification front (i.e., the lithosphere) and a larger scale flow associated with a discontinuous upward heat flux (i.e., a fracture zone) has been shown. The flows exist simultaneously and each may have a significant role in deciding the thermal evolution of the lithosphere and in understanding the relation of shallow mantle convection to deep mantle convection. This overall process is reflected in the geoid, gravity, and topographic anomalies in the north-central Pacific. These highly correlated fields of intermediate wavelength (approx. 200 to 2000 km) show isostatic compensation by a thin lithosphere for shorter (less than or equal to approx. 500 km), but not the longer, wavelengths. The ultimate, dynamic origin of this class of anomalies is being investigated.

1586 (N–89-26308) **Oscillations in D-region absorption at periods of one to two months.** Stanford, J.L.; Saksena, R.C. Oxford Univ. (UK). 1989. 14p. (NASA-CR–184684;NAS–1.26:184684). Available from NTIS, PC A03/MF A01.

One to two month oscillations in D-region absorption are found in seven years of daily f-min data from low latitude stations at Singapore (1N, 104E) and Rarotonga (21S, 160W). Coherency (cross-spectral) analyses reveal that solar flux variations account for much of the f-min variance at these periods. Over the range of periods from 10 to 200 days, statistically significant linear correlation is found between the f-min time series and contemporaneous 10.7 cm solar flux mearurements at periods of 16 to 19 days, the 26 to 29 day solar rotation band, and a broad band covering 43 to 80 day periods.

1587 (N–89-26334, pp. 20-21) **Isotope Ratio Monitoring Gas Chromatography Mass Spectrometry (IRM-GCMS).** Freeman, K.H.; Ricci, S.A.; Studley, A.; Hayes, J.M. National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center. Mar 1989. (NASA-CP–10027;A–89098;NAS–1.55:10027;CONF-8803241–: Conference on exobiology and future mars missions, Sunnyvale, CA (USA), Mar 1988). In *Exobiology and future Mars missions.* Available from NTIS, PC A04/MF A01.

Abstract Only.

On Earth, the C-13 content of organic compounds is depleted by roughly 13 to 23 permil from atmospheric carbon dioxide. This difference is largely due to isotope effects associated with the fixation of inorganic carbon by photosynthetic organisms. If life once existed on Mars, then it is reasonable to expect to observe a similar fractionation. Although the strongly oxidizing conditions on the surface of Mars make preservation of ancient organic material unlikely, carbon-isotope evidence for the existence of life on Mars may still be preserved. Carbon depleted in C-13 could be preserved either in organic compounds within buried sediments, or in carbonate minerals produced by the oxidation of organic material. A technique is introduced for rapid and precise measurement of the C-13 contents of individual organic compounds. A gas chromatograph is coupled to an isotope-ratio mass spectrometer through a combustion interface, enabling on-line isotopic analysis of isolated compounds. The isotope ratios are determined by integration of ion currents over the

course of each chromatographic peak. Software incorporates automatic peak determination, corrections for background, and deconvolution of overlapped peaks. Overall performance of the instrument was evaluated by the analysis of a mixture of high purity n-alkanes of know isotopic composition. Isotopic values measured via IRM-GCMS averaged withing 0.55 permil of their conventionally measured values.

1588 (N–89-26334, pp. 46-49) **Chemical evolution: A solar system perspective.** Oro, J. National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center. Mar 1989. (NASA-CP–10027;A–89098;NAS–1.55:10027). In *Exobiology and future Mars missions.* Available from NTIS, PC A04/MF A01.

During the last three decades major advances were made in the understanding of the formation of carbon compounds in the universe and of the occurrence of processes of chemical evolution in the solar system and beyond. This was made possible by the development of new astronomical techniques and by the exploration of the solar system by means of properly instrumented spacecraft. Some of the major findings made as a result of these observations are summarized.

1589 (N–89-26783) **Neutron stars and white dwarfs in galactic halos.** Ryu, Dongsu; Olive, K.A.; Silk, J. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 29p. (NASA-CR–185352;NAS–1.26:185352;FERMILAB-PUB–89/119-A). Available from NTIS, PC A03/MF A01.

The possibility that galactic halos are composed of stellar remnants such as neutron stars and white dwarfs is discussed. On the basis of a simple model for the evolution of galactic halos, researchers follow the history of halo matter, luminosity, and metal and helium abundances. They assume conventional yields for helium and the heavier elements. By comparing with the observational constraints, which may be considered as fairly conservative, it is found that, for an exponentially decreasing star formation rate (SFR) with e-folding time tau, only values between 6 x 10(8) less than similar to tau less than similar to 2 x 10(9) years are allowed together with a very limited range of masses for the initial mass function (IMF). Star formation is allowed for 2 solar mass less than similar to m less than similar to 8 solar mass if tau = 2 x 10(9) years, and for 4 solar mass less than similar to m less than similar to 6 solar mass if tau = 10(9) years. For tau = 6 x 10(8) years, the lower and upper mass limits merge to similar to 5 solar mass. Researchers conclude that, even though the possibility of neutron stars as halo matter may be ruled out, that of white dwarfs may still be a viable hypothesis, though with very stringent constraints on allowed parameters, that merits further consideration.

1590 (N–89-26784) **The search for absorption of 1 keV X-rays by the Small Magellanic Cloud.** Marazas, B. Pennsylvania State Univ., University Park, PA (USA). May 1989. 37p. (NASA-CR–185348;NAS–1.26:185348). Available from NTIS, PC A03/MF A01.

The contribution of the extragalactic component of the diffuse background to the 1 keV energy band remains unknown. An effective way to ascertain this contribution is to measure the absorption of the extragalactic component by the neutral hydrogen in the Small Magellanic Cloud (SMC) with an instrument capable of eliminating point sources from the X-ray data that compensate for absorption. The image proportional counter data from the Einstein observatory can be used for this purpose. Additionally, any extended emission must also be eliminated. The resulting source free data can be compared to the neutral hydrogen and the amount of absorption can then be obtained when compared to the diffuse flux away from the SMC. However, due to other types of radiation contaminating the X-ray data, a true measure of the X-ray absorption was not obtained.

1591 (N–89-26791) **Light propagation and the distance-redshift relation in a realistic inhomogeneous universe.** Futamase, Toshifumi; Sasaki, Misao. Fermi National Accelerator Lab., Batavia, IL (USA). Apr 1989. 26p. (NASA-CR–185041;NAS–1.26:185041;FERMILAB-PUB–89/111-A). Available from NTIS, PC A03/MF A01.

The propagation of light rays in a clumpy universe constructed by cosmological version of the post-Newtonian approximation was investigated. It is shown that linear approximation to the propagation equations is valid in the region where zeta is approximately less than 1 even if the density contrast is much larger than unity. Based on a gerneral order-of-magnitude statistical consideration, it is argued that the linear approximation is still valid where zeta is approximately greater than 1. A general formula for the distance-redshift relation in a clumpy universe is given. An explicit expression is derived for a simplified situation in which the effect of the gravitational potential of inhomogeneities dominates. In the light of the derived relation, the validity of the Dyer-Roeder distance is discussed. Also, statistical properties of light rays are investigated for a simple model of an inhomogeneous universe. The result of this example supports the validity of the linear approximation.

1592 (N–89-26792) **Rate for annihilation of galactic dark matter into two photons.** Giudice, G.F.; Griest, K. Fermi National Accelerator Lab., Batavia, IL (USA). Apr 1989. 35p. (NASA-CR–185029;NAS–1.26:185029;FERMILAB-PUB–89/113-A). Available from NTIS, PC A03/MF A01.

A calculation of the cross section for neutralino-neutralino annihilation into two photons is performed and applied to dark matter in the galactic halo to find the counting rate in a large gamma ray detector such as EGRET (Energetic Gamma Ray Experiment Telescope) or ASTROGAM. Combining constraints from particle accelerators with the requirement that the neutralinos make up the dark matter, it is found that rates of over a few dozen events per year are unlikely. The assumptions that go into these conclusions are listed. Other particle dark matter candidates which could give larger and perhaps observable signals are suggested.

1593 (N–89-26793) **Ideal black hole gas.** Smalley, L.L. National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center. Aug 1989. 12p. (NASA-TM–101788;NAS–1.15:101788). Available from NTIS, PC A03/MF A01.

The concept of a primordial blackhole fluid with intrinsic spin density is examined along with its consequence for supercluster-sized, i.e., large scale voids, and the missing mass question.

1594 (N–89-26794) **Gravitational radiation from extreme Kerr black hole.** Sasaki, Misao; Nakamura, Takashi. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 20p. (NASA-CR–185350;NAS–1.26:185350;FERMILAB-PUB–89/122-A). Available from NTIS, PC A03/MF A01.

Gravitational radiation induced by a test particle falling into an extreme Kerr black hole was investigated analytically. Assuming the radiation is dominated by the infinite sequence of quasi-normal modes which has the limiting frequency m/(2M), where m is an azimuthal eigenvalue and M is the mass of the black hole, it was found that the radiated energy diverges logarithmically in time. Then the back reaction to the black hole was evaluated by appealing to the energy and angular momentum conservation laws. It was found that the radiation has a tendency to increase the ratio of the angular momentum to mass of the black hole, which is completely different from non-extreme case, while the contribution of the test particle is to decrease it.

1595 (N–89-26795) **Complete positive ion, electron, and ram negative ion measurements near Comet Halley (COPERNIC) plasma experiment for the European Giotto Mission. Final report, 15 April 1982-31 March 1988.** Lin, R.P. California Univ., Berkeley, CA (USA). May 1988. 23p. (NASA-CR–185345;NAS–1.26:185345). Available from NTIS, PC A03/MF A01.

Participation of U.S. scientists on the COPERNIC (COmplete Positive ions, Electrons and Ram Negative Ion measurements near Comet Halley) plasma experiment on the Giotto mission is described. The experiment consisted of two detectors: the EESA (electron electrostatic analyzer) which provided three-dimensional measurements of the distribution of electrons from 10 eV to 30 keV, and the PICCA (positive ion cluster composition analyzer) which provided mass analysis of positively charged cold cometary ions from mass 10 to 210 amu. In addition, a small 3 deg wide sector of the EESA looking in the ram direction was devoted to the detection of negatively charged cold cometary ions. Both detectors operated perfectly up to near closest approach (approx. 600 km) to Halley, but impacts of dust particles and neutral gas on the spacecraft contaminated parts of the data during the last few minutes. Although no

flight hardware was fabricated in the U.S., The U.S. made very significant contributions to the hardware design, ground support equipment (GSE) design and fabrication, and flight and data reduction software required for the experiment, and also participated fully in the data reduction and analysis, and theoretical modeling and interpretation. Cometary data analysis is presented.

1596 (PB–89-158323/XAB) **Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Aug 1985. 110p. (SGD–492-PT-1). Available from NTIS, PC A06/MF A01.

See also PB–89-130835 and PB–89-158331.

Contents include: detailed index for 1984-1985; data for July 1985–IUWDS alert periods (advance and worldwide), solar activity indices, solar flares, solar radio emission, Stanford mean solar magnetic field; data for June 1985–solar-active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic-ray measurements by neutron monitor, geomagnetic indices, radio propagation indices; and late data–cosmic rays, calcium plage data.

1597 (PB–89-158331/XAB) **Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Aug 1985. 60p. (SGD–492-PT-2). Available from NTIS, PC A04/MF A01.

See also PB–89-158323.

Contents include: detailed index for 1984-1985; data for february 1985 – meudon Carte Synoptique, solar radio bursts at fixed frequencies, solar x-ray radiation from GOES satellite, mass ejections from the sun, active prominences and filaments; data for August - September 1983 – solar flares August 1983, solar flares September 1983, number of flares August 1966 - September 1983.

1598 (PB–89-158349/XAB) **Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Feb 1981. 171p. (SGD–438-PT-1). Available from NTIS, PC A08/MF A01.

See also PB–89-130835 and PB–89-158356.

Contents include: index for 1970-1980; January 1981 data – alert periods, daily solar indices, solar flares, solar radio emission, coronal holes, inferred interplanetary magnetic field polarities, mean solar magnetic field, spacecraft observations, December 1980 data – daily solar-activity centers, sudden ionospheric disturbances, spacecraft observations, solar radio emission, cosmic rays, geomagnetic indices, radio-propagation indices; late data – solar radio emission November, December 1980, spacecraft observations November 1980, cosmic rays, Huancayo Oct 1980 – climax, alert, Deep River Nov 1980.

1599 (PB–89-162481/XAB) **Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Jan 1989. 150p. (SGD–533-PT-1). Available from NTIS, PC A07/MF A01.

See also Part 2, PB–89-162499 and PB–88-240403.

Contents include: detailed index for 1988; data for December 1988–IUWDS alert periods (advance and worldwide), solar-activity indices, solar flares, solar radio emission, stanford mean solar magnetic field; data for November 1988 - solar-active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, radio propagation indices; late data–pioneer xii interplanetary magnetic field magnitudes january-june 1988, cosmic ray measurements by neutron monitor, geomagnetic sudden commencements/solar flare effects october 1988.

1600 (PB–89-162499/XAB) **Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Jan 1989. 99p. (SGD–533-PT-2). Available from NTIS, PC A05/MF A01.

See also Part 1, PB–89-162481.

Contents include: detailed index for 1988; data for July 1988 - Meudon carte synoptique, solar flares, solar radio bursts at fixed frequencies, solar x-ray radiation from GOES satellite, mass ejections from the sun, active prominences and filaments.

1601 (PB–89-163695/XAB) **Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note.** Sime, D.G.; Garcia, C.J.; Lundin, W.E.; Yasukawa, E.A. National Center for Atmospheric Research, Boulder, CO (USA). Nov 1988. 90p. (NCAR/TN–326+STR). Available from NTIS, PC A05/MF A01.

See also PB–84-117167.

The general goal of the HAO/University of Hawaii Joint Solar Dynamics Project is to establish the relationships that exist between the solar magnetic field, detected in the photosphere, and the structure and evolution of the corona. The SOLDYN programs of 1982 and 1983 demonstrated the ability to use existing instruments to gather data of value in the pursuit of that goal. The goals for the observations in 1988 are as follows: (1) document the state of the sun, from the photosphere up through the chromosphere and out into the corona for the approximately four-week interval around the total solar eclipse of 18 March 1988, and (2) identify the relationship between the photospheric magnetic fields and the temperature and density structure of the corona. This report contains the reduced observations made during this SOLDYN III period necessary to achieve these goals. They are presented both in the form of daily photographic and photoelectric measurements, and in synoptic format for the period.

1602 (PB–89-215461/XAB) **MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988.** Dryer, M. National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab. Apr 1989. 27p. (SEL–1216). Available from NTIS, PC A03/MF A01.

The objective was to use magnetohydrodynamic (MHD) numerical modeling and simulations as tools to understand the physics of energy and momentum transport from the solar surface through the corona to interplanetary space. To achieve this goal, possible physical mechanisms were identified and synthesis calculations were performed using self-consistent MHD theory via numerical and analytical methods. Solar and interplanetary (remote-sensing and in situ) observations play important roles in the synthesis strategy. The models, unique in the field of solar/interplanetary physics, include both 2 1/2-D and 3-D time-dependent codes that could lead to future operational status in geomagnetic storm forecasting procedures. Following a short Introduction, the report consists of a Summary providing highlights of the research project. A Bibliography of papers, tabulated by first author for easy reference, follows the Summary. The various papers are categorized with a description of their main points and conclusions. A set of representative figures, with extensive descriptive captions, is included for the reader interested in additional details.

1603 (UCRL–101115) **Equation of state and opacity of dense plasmas.** Rogers, F.J.; Iglesias, C.A. Lawrence Livermore National Lab., CA (USA). 28 Sep 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908133–5: 24. Yamada conference on strongly coupled plasma physics, Tokyo (Japan), 29 Aug - 2 sep 1989). Order Number DE90002223. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent research on the equation of state and opacity of dense plasmas has been strongly driven by discrepancies between calculation and observation of a wide variety of astrophysical quantities such as, the solar neutrino flux rate, the period ratio of Cepheid variable stars, and lithium depletion in the Hyades stellar cluster. A summary of some recent work based on a many-body activity expansion of the grand-partition function is given. An integral part of this work involves methods for calculating atomic data and occupation numbers for excited states in dense plasmas. 42 refs.

1604 (UCRL–101924) **Equation of state data of shock compressed liquid CO_2 and synthetic Uranus.** Mitchell, A.C.;

Nellis, W.J.; Holmes, N.C.; Erskine, D.J.; McCandless, P.C.; Ravizza, D.L.; Cassidy, L.D. Lawrence Livermore National Lab., CA (USA). Sep 1989. 1p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890812–61: American Physical Society topical conference on shock compression of condensed matter, Albuquerque, NM (USA), 14-17 Aug 1989). Order Number DE90002221. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

New Hugoniot equation-of-state data for liquid $CO_2$and synthetic Uranus are discussed. These CO_2 data and the previous data of Schott indicate that CO_2 begins to dissociate at about 33 GPa on the Hugoniot. Four double-shock points were obtained for synthetic Uranus up to 220 GPa and 3 g/cm^3. These data are coincident with the adiabat of Uranus calculated by Hubbard and Marley. 3 refs.

1605 Publications of the Observatory of the University of Michigan. Volume 12, no. 2: Wavelength identifications in the magnetic CP star HR 4816 (HD 110066). Bidelman, W.P.; Cowley, C.R.; Roemmelt, J.C. 54p. Case Western Reserve Univ., Cleveland, OH (US) (1988).

The unusually sharp spectral lines of HR 4816 make it particularly well suited for identification work at high dispersion. The 2A/mm spectrogram (EC 103) was taken at the Lick Observatory. The UT data of mid-exposure was 7.26 June 1960, (2437092.76). The bulk of the identifications were made in 1960, from wavelengths measured with a conventional engine. In the list, the stellar wavelengths are in the first column, followed by an estimate of the intensity and character of the line, the identifications begin in column 4 with decimal fractions of an angstrom. The multiplet number follows the symbol for the atomic spectrum.

1606 Near-infrared spectroscopy of young stellar objects. Ph.D. Thesis. Carr, J.S. Thesis. 219p. Texas University, Austin, TX (US) (1988).

Near-infrared spectroscopic observations of young stellar objects are presented. Spectra were obtained of the first overtone bands of CO, the hydrogen Br gamma line, and the S(1)v=1-0 line of H2. The majority of objects observed have luminosities less than 1000 solar luminosity. The CO overtone bands were found in emission in 6 out of 31 objects. Two models are discussed for producing the CO emission. In the first, models are calculated for steady state accretion disks. The radial distribution of temperature in the disk was calculated by balancing the heating and cooling in the disk. The resulting model disks have optically thin regions with sufficient temperatures and densities for vibrational excitation of CO. The models also reproduce the observed increase in CO luminosity with increasing stellar luminosity. The second model considered is a spherical, stellar wind with velocities of 100 to 300 km/s. The CO emission from the wind is computed as a function of mass loss rate. Thirty objects were measured for Br gamma emission. Four new detections of H2 emission in young stars are also reported. It was also verified that the proportionality between hydrogen recombination line strength and stellar luminosity extends down to 1 solar luminosity objects. The relation of recombination line emission to radio continuum emission, the momentum in the ionized wind, and the relationship of the ionized gas to large scale molecular outflows are discussed.

1607 The strange density of Mercury - Theoretical considerations. Cameron, A.G. W.; Benz, W.; Fegley, B. Jr.; Slattery, W.L. pp. 802 of Mercury. Vilas, F.; Chapman, C.R.; Matthews, M.S. University of Arizona Press, Tucson, AZ (US) (1988).

Two classes of models which have been advanced to explain the high density of Mercury are reviewed and contrasted. These models invoke either the differing volatilities of iron and silicates or disruptive collisions to fractionate the two phases. Also contrasted are equilibrium condensation and planetary vaporization models, both of which fall within the first broad class considered. Results indicate that equilibrium condensation models are unable to account for the observed high density of Mercury without invoking special mechanisms such as unrealistically narrow planetary accretion zones. However, it is found that distinctive chemical differences, which are potentially testable by spacecraft experiments, provide means for distinguishing between planetary vaporization and large impact scenarios.

1608 Formation of shell galaxies. II. Nonspherical potentials. Hernquist, L. (California Univ., Berkeley (USA)); Quinn, P.J. *Astrophysical Journal (USA)*, 342: 1-16 (Jul 1989).

The formation of shells through interactions of low-mass companions with nonspherical galaxies is investigated using the restricted three-body method. We find that sharp-edged features remain a common outcome of such encounters, regardless of the detailed structure of the more massive galaxy. The morphology and alignment of the resulting shell system are sensitive to the form of the potential of the primary galaxy; however, they depend also on the orbital parameters of the collision and on the nature of the companion. The latter two considerations imply that it will be difficult to infer the intrinsic shapes of luminous ellipticals from observations of shells. 22 refs.

1609 Organic solids produced from simple C/H/O/N ices by charged particles - Applications to the outer solar system. Khare, B.N.; Thompson, W.R.; Chyba, C.F.; Sagan, C.; Arakawa, E.T. *Advances in Space Research (USA)*, 9(2): 41-53 (1989). (CONF-880780–: 27. plenary meeting of COSPAR, Espoo (Finland), 18-29 Jul 1988).

The effects of charged particle irradiation by cold plasma discharge on surfaces of H2O:CH4 clathrate with a 200:1 ratio and on ices composed of H2O and C2H6 or C2H2 are examined. The molecules studies are found in Comet Halley and are plausible constituents in icy outer solar system objects. The IR transmission spectra of four ice-tholin residues obtained in the laboratory are compared with spectra produced by irradiation of gases and ices containing simple hydrocarbons. The similarities between CH4 clathrate residue and Halley organic grains, and the surface transport or atmospheric replenishment activity on Triton and Pluto are discussed. 56 refs.

1610 Quenching the cosmological constant. Taylor, T.R. (Fermi National Accelerator Lab., Batavia, IL (USA)); Veneziano, G. *Physics Letters [Section] B (Netherlands)*, 228(3): 311-316 (21 Sep 1989).

We propose and try to justify a model - inspired by known features of one-loop quantum gravity corrections - in which the effective cosmological constant is consistent with inflationary needs at early times and sufficiently suppressed at later epochs. (orig.).

1611 Radio emission from young supernova remnants - Effects of an inhomogeneous circumstellar medium. Dickel, J.R. (Illinois Univ., Urbana (USA)); Eilek, J.A.; Jones, E.M.; Reynolds, S.P. *Astrophysical Journal, Supplement Series (USA)*, 70: 497-538 (Jul 1989).

The evolution of young supernova remnants has been modeled using a one-dimensional hydrodynamics code. Rayleigh-Taylor instabilities and the growth of Rayleigh-Taylor fingers have been included in the code. Turbulent dynamo amplification of magnetic fields and both turbulent and shock acceleration of relativistic electrons have been included macroscopically. From this, the distribution of synchrotron luminosity in the remnant has been calculated. It is found that the radio morphology of model remnants expanding into a homogeneous medium does not agree with observations. Expansion into a circumstellar medium with many small cloudlets does produce radio shells which agree with observations. It is suggested that supernova remnants reflect the interaction of ejected matter with a cloudy circumstellar medium. 77 refs.

1612 Model dependence of astrophysical lower bounds on the neutrino mass. Ralston, J.P. (Department of Physics and Astronomy, University of Kansas, Lawrence, Kansas 66045 (US)). *Physical Review Letters (USA)*, 63(10): 1038-1041 (4 Sep 1989).

Astrophysical lower bounds on the neutrino mass require assumptions about the phase-space distribution in dark-matter halos. Even with perfect spherical symmetry, a collisionless dark-matter halo can have an anisotropic phase-space distribution from angular momentum conservation. An example gives much less restrictive condition on the neutrino mass, showing that bounds such as that of Tremaine and Gunn are model dependent. I conclude that current mass bounds on neutrinos derived from dwarf galaxy rotation curves are overly restrictive, so that neutrinos in the mass range of 10–100 eV remain a viable candidate for galactic dark matter.

1613 Oscillations of solar models with internal element diffusion. Cox, A.N. (Los Alamos National Lab., NM (USA)); Guzik, J.A.; Kidman, R.B. *Astrophysical Journal (USA)*, 342: 1187-1206 (Jul 1989).

Data on the evolution of a solar model are presented which include the effects of diffusive processes that lead to a partial sorting of the elements with depth. The two models are with and without the effects of diffusion. The diffusion process of gravitational settling, composition gradient diffusion, and thermal diffusion are based on the method of Iben and MacDonald (1985). It is found that a high original helium content is required to match the observed global oscillation data, and that the total neutrino flux detectable by the chlorine detector accordingly is increased to over 10 SNU. 111 refs.

1614 Electromagnetic waves and instabilities from cometary ion velocity shell distributions. Gary, S.P. (Earth and Space Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico (US)); Sinha, R. *Journal of Geophysical Research (USA)*, 94(A7): 9131-9138 (1 Jul 1989).

This paper considers the linear theory of electromagnetic waves and instabilities in the solar wind in the presence of cometary ions with complete velocity shell distribution functions. A collisionless, homegeneous plasma, propagation parallel or antiparallel to a uniform magnetic field and frequencies below the proton cyclotron frequency are considered. If there is no relative drift speed between the cometary ions and the solar wind protons, both right- and left-hand polarized modes are stable, with ion cyclotron damping at wavenumbers of the order of the inverse cometary ion gyroradius. If there is a relative drift between the cometary ions and the solar wind protons greater than the Alfven speed, both the ion/ion right-hand and left-hand resonant instabilities grow with maximum growth rates which increase as the shell distributions become narrower in velocity space. © American Geophysical Union 1989

6402 Atmospheric Physics

Refer also to citation(s) 1554, 1564, 1567, 1596, 1598, 1599, 1896, 1897, 1898, 1899

1615 (AD-A-201266/4/XAB) **Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988.** Ulwick, J.C.; Baker, K.D.; Steed, A.J. Utah State Univ., Logan, UT (USA). Center for Space Engineering. Aug 1988. 27p. Available from NTIS, PC A03/MF A01.

The primary objective of this project was the investigation of the spatial and temporal structuring and photochemistry of the infrared airglow and the dynamic processes that modify the physical and radiative properties of the polar mesosphere. The approach was to conduct ground-based mesospheric/stratospheric/tropospheric (MST) radar measurements and rocket-borne probes. Rockets containing DEC probes were launched to measure electron-density irregularities with high spatial resolution. They were launched at times when the MST radar showed regions of intense backscatter in the mesosphere. Large changes and strong gradients in the electron density were observed in the region of most intense backscatter. Several results from the spectra, in agreement with present theories, are as follows: (1) The electron fluctuation spectrum displayed both a Kolmogorov inertial subrange and a viscous subrange characterized by an inner scale for turbulence. (2) The inner scale size for the electron gas varies with the energy dissipation rate in a manner predicted by classical turbulence theory. (3) The 50-MHz scattering signal is in qualitative agreement with the in-situ measurements. Some of the more controversial results found are: (1) The microscale for turbulence in the electron gas is much smaller than expected. (2) The electrons seem to behave as a passive scalar but one with a large Schmidt number. (3) The fact that strong high latitude mesospheric scatter occurs at all for a 50 MHz radar is due to the unusual character of the electron spectrum. (4) For weak electron-density gradients the electron spectrum has a Kolmogorov form, but for the case of strong gradients, the spectrum is steepened.

1616 (AD-A-205210/8/XAB) **Ionospheric scintillation studies. Final report, October 1984-September 1987.** Livingston, R.C. SRI International, Menlo Park, CA (USA). 1 May 1988. 43p. Available from NTIS, PC A03/MF A01.

Irregular structure in ionospheric plasma density can significantly affect DoD communications and radar systems that utilize transionospheric radiowave paths. Transport and dissipation of ionospheric structure is therefore of direct relevance. Such an understanding can aid the long-term goal of developing a predictive capability for global ionospheric structure. Experimental observation of the ionosphere over the past few years has concentrated on high latitudes. This is the most-complex portion of the global ionospheric system; the auroral zone, the polar cap, and the boundary between them can all be regions of highly dynamic and structured plasma. In the polar cap, very-large-scale plasma patches and sun-aligned arcs occur, and can convect rapidly from their source regions to the entire high-latitude region. Much of what has been learned about this extended regime of irregularity structure at high latitudes has been through the application of complementary diagnostics: Optics, ionosonde, incoherent scatter radar, in-situ satellite, and scintillation measurements. These various techniques allow the observation of structure over several orders of magnitude in spatial scale. The optics, ionosonde, and radar provide an overall view of large-scale production and dynamics; the satellites diagnose the inputs to the large- and medium-scale irregularities; from the scintillation data, the strength, shape, and motion of the kilometer-scale structure can be identified.

1617 (AD-A-209954/7/XAB) **Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988.** Lin, C.S. Southwest Research Inst., San Antonio, TX (USA). 31 Dec 1988. 54p. Available from NTIS, PC A04/MF A01.

This report documents the numerical code developed for solving the dispersion equation of the electromagnetic dispersion equation for a finite-radius electron beam in a neutralizing background. Derivation of the dispersion equation from the fluid equation and Maxwell's equations is described. To study electromagnetic radiation induced by electron-beam injection from the Space Shuttle, the numerical code is applied to solve for the instability growth rates for the beam and whistler modes. The numerical solutions indicate that a finite-radius electron beam injected into the ionosphere with the beam energy around 1 keV and current about 100 mA can drive the beam and whistler modes unstable. The results can explain the whistler waves radiated from the keV electron beam injected from Spacelab 2.

1618 (AD-A-209993/5/XAB) **Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report.** Keskinen, M.J. Naval Research Lab., Washington, DC (USA). 15 Jun 1989. 27p. (NRL-MR-6481). Available from NTIS, PC A03/MF A01.

Constraints on and scaling laws associated with the power spectrum of interchange instabilities in the inertial regime in the high-latitude ionosphere are derived using conservation laws implied by the fundamental nonlinear plasma fluid equations. Applications to large-scale convecting high-latitude ionospheric-plasma density structures, patches, and enhancements are made.

1619 (AD-A-955551/7/XAB) **Study of low-energy electrons over the polar region by using the USAF (United States Air Force) operational DMSP satellite. Final technical report.** Anderson, K.A. California Univ., Berkeley, CA (USA). Space Sciences Lab. Dec 1978. 43p. Available from NTIS, PC A03/MF A01.

POLAR REGIONS/electrons; AURORAL ZONES/electrons; AURORAE; ELECTRONS; SATELLITES; PROGRESS REPORT

1620 (INIS-BR-1624, pp. 1) **Overview of the ionospheric research at INPE.** Abdu, M.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276-: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERE/dynamics; IONOSPHERE/electrodynamics; IONOSPHERE/research programs; IONOSPHERE; DYNAMICS; ELECTRODYNAMICS; LATITUDE EFFECT

1621 (INIS-BR–1624, pp. 4) **Upper atmospheric research in Brazil.** Clemesha, B.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. AEROSOLS/brazil; AEROSOLS/earth atmosphere; EARTH ATMOSPHERE/brazil; EARTH ATMOSPHERE/research programs; GRAVITY WAVES/brazil; GRAVITY WAVES/earth atmosphere; AEROSOLS; BRAZIL; PHOTOMETRY; ROCKETS

1622 (INIS-BR–1624, pp. 6) **Ozone in the tropics: satellite studies.** Fishman, J. (National Aeronautics and Space Administration, Langley AFB, VA (USA). Langley Research Center). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. OZONE LAYER/satellites; OZONE LAYER/stratosphere; SATELLITES; STRATOSPHERE; QUANTITY RATIO

1623 (INIS-BR–1624, pp. 5) **Low latitude electric fields.** Fejer, B.G. (Utah State Univ., Logan (USA). Center for Atmospheric and Space Sciences). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. LATITUDE EFFECT/electric fields; LATITUDE EFFECT/ionosphere; EQUATOR; IONOSONDES; IONOSPHERE; PLASMA INSTABILITY; RADAR

1624 (INIS-BR–1624, pp. 7) **Ozone layer and the NASA airbone Antartic experiment of 1987.** Fishman, J. (National Aeronautics and Space Administration, Langley AFB, VA (USA). Langley Research Center). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ATMOSPHERIC CHEMISTRY/antarctic regions; OZONE LAYER/antarctic regions; OZONE LAYER/holes; NASA; HOLES; STRATOSPHERE

1625 (INIS-BR–1624, pp. 8) **Development in predictions of auroral radio wave absorption in the southern hemisphere.** Foppiano, A. (Chile). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. RADIOWAVE RADIATION/absorption; RADIOWAVE RADIATION/auroral zones; ABSORPTION; SOUTHERN HEMISPHERE

1626 (INIS-BR–1624, pp. 9) **Aspects of broad band electrostatic emissions in the magnetotail.** Gomberoff, L. (Chile). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ION BEAMS/earth magnetosphere; ION BEAMS/interactions; PLASMA/earth magnetosphere; PLASMA/interactions; BOLTZMANN STATISTICS; INTERACTIONS; LINE BROADENING; MAGNETOTAIL; PLASMA; PLASMA INSTABILITY

1627 (INIS-BR–1624, pp. 10) **Research in magnetospheric physics at INPE: results and perspectives.** Gonzalez, W.D. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH MAGNETOSPHERE/magnetic storms; AURORAE; CHARGED-PARTICLE PRECIPITATION; ELECTRIC FIELDS; INTERPLANETARY MAGNETIC FIELDS; PLASMASPHERE; SOUTHERN HEMISPHERE; X RADIATION

1628 (INIS-BR–1624, pp. 11) **Modern problems in physics of variations of the ionosphere at the altitudes 100-200 Km.** Ivanov-Kholodny, G.S. (USSR). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. E REGION/seasonal variations; F1 LAYER/seasonal variations; IONS; PARTICLE INTERACTIONS; RECOMBINATION; SOLAR ACTIVITY

1629 (INIS-BR–1624, pp. 12) **Ozone measurements in Brazil.** Kirchhoff, V.W.J.H. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. OZONE/stratosphere; BRAZIL; OZONE; STRATOSPHERE

1630 (INIS-BR–1624, pp. 13-14) **Present status of the ozone layer.** Kirchhoff, V.W.J.H. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. OZONE LAYER/holes; OZONE LAYER/stratosphere; OZONE LAYER/ultraviolet radiation; ATMOSPHERIC CHEMISTRY; HOLES; STRATOSPHERE; TROPOSPHERE

1631 (INIS-BR–1624, pp. 15) **Peculiarity of the equatorial ULF.** Kitamura, T.-I. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics); Shinohara, M.; Veliz, O.; Ishitsuka, M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ULTRALOW FREQUENCY RADIATION/ionosphere; ULTRALOW FREQUENCY RADIATION/wave propagation; EQUATOR; IONOSPHERE

1632 (INIS-BR–1624, pp. 16) **Hydromagnetic phenomena at the magnetopause and in the magnetosphere.** Lanzerotti, L.J. (AT and T Bell Laboratories, Murray Hills, NJ (USA)). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. HYDROMAGNETIC WAVES/earth magnetosphere; HYDROMAGNETIC WAVES/magnetopause; AURORAE; BOUNDARY LAYERS; ELECTRIC FIELDS; GEOMAGNETIC FIELD; MAGNETOPAUSE

1633 (INIS-BR–1624, pp. 19) **VLF wave phenomena inside the plasmasphere and at the upper ionosphere.** Molchanov, O.A.

(USSR). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. LONG WAVE RADIATION/earth magnetosphere; LONG WAVE RADIATION/plasmasphere; LONG WAVE RADIATION/wave propagation; AURORAL HISS; COHERENT PRODUCTION; PLASMASPHERE; WHISTLERS

1634 (INIS-BR–1624, pp. 22-23) **Simultaneous rocket and radar measurements of plasma instabilities in the Equatorial electrojet.** Pfaff Junior, R.F. (National Aeronautics and Space Administration, Greenbelt, MD. Goddard Inst. for Space Studies). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTROJETS/plasma instability; ELECTROJETS; PLASMA DENSITY; PROBES; WAVE PROPAGATION

1635 (INIS-BR–1624, pp. 27) **Global problems in solar-terrestrial research.** Roederer, J.G. (Alaska Univ., College, AK (USA)). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH ATMOSPHERE/interactions; EARTH ATMOSPHERE/solar radiation; SOLAR RADIATION/earth atmosphere; SOLAR RADIATION/interactions; INTERACTIONS

1636 (INIS-BR–1624, pp. 30) **Near-equatorial ion-cyclotron phenomenon in upper ionosphere by satellite data.** Sobolev, Ya. P. (USSR). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ION PLASMA WAVES/geomagnetic equator; ION PLASMA WAVES/ionosphere; IONOSPHERE; WAVE PROPAGATION

1637 (INIS-BR–1624, pp. 31) **Coupling and controls of ionospheric processes in the composite solar-terrestrial system.** Szuszczewicz, E.P. (Science Applications, Inc., McLean, VA (USA). Lab. for Atmospheric and Space Sciences). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERIC STORMS/interplanetary space; PLASMA INSTABILITY; SOLAR SYSTEM

1638 (INIS-BR–1624, pp. 32) **Geomagnetic research in Brazil.** Trivedi, N.B. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GEOMAGNETIC FIELD/charged-particle precipitation; GEOMAGNETIC FIELD/research programs; BRAZIL; ELECTROJETS; MAGNETIC STORMS; SOUTHERN HEMISPHERE

1639 (INIS-BR–1624, pp. 33) **Interplanetary magnetic phenomena and processes and the resultant control of geomagnetic activity at earth.** Tsurutani, B.T. (California Inst. of tech., Pasadena, CA (USA)); Goldstein, B.E.; Gonzalez, W.D.; Tang, F.; Akasofu, S.I.; Brinca, A.L.; Anderson, R.R.; Eastman, T.E. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. INTERPLANETARY MAGNETIC FIELDS/geomagnetic field; INTERPLANETARY MAGNETIC FIELDS/magnetic storms; SEASONAL VARIATIONS; SOLAR CYCLE

1640 (INIS-BR–1624, pp. 34-35) **On the excitation mechanism of oxygen-related emissions in the airglow and aurora.** Witt, G. (Stockholm Univ. (Sweden). Dept. of Meteorology). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH ATMOSPHERE/airglow; EARTH ATMOSPHERE/aurorae; OXYGEN/earth atmosphere; OXYGEN/excitation; AIRGLOW; AURORAE; MEASURING METHODS; OXYGEN; EXCITATION; QUANTITY RATIO

1641 (INIS-BR–1624, pp. 42-43) **Solar modulation on annual and semi-annual geomagnetic variations.** Gianibelli, J.C. (Universidad Nacional de La Plata, La Plata (Argentina). Facultad de Ciencias Astronomicas y Geofisicas); Weisz, S.G. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (In Portuguese). (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GEOMAGNETIC FIELD/solar activity; GEOMAGNETIC FIELD/time dependence; SOLAR ACTIVITY/geomagnetic field; SOLAR ACTIVITY/time dependence; MAGNETOPAUSE

1642 (INIS-BR–1624, pp. 44-45) **Daily asymmetry of magnetic storms of analytical methods.** Grimberg, B.I. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina)); Schneider, O. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (In Spanish). (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/analytical solution; MAGNETIC STORMS/solar cycle; MAGNETIC STORMS/time dependence; ASYMMETRY; FOURIER ANALYSIS; GEOMAGNETIC FIELD

1643 (INIS-BR–1624, pp. 46-47) **Field longitudinal assymmetry model for geomagnetic storms.** Grimberg, B.J. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina)); Schneider, O. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (In Portuguese). (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GEOMAGNETIC FIELD/magnetic storms; GEOMAGNETIC FIELD/time dependence; MAGNETIC STORMS/asymmetry; ASYMMETRY

1644 (INIS-BR–1624, pp. 48) **Effects of electrical inhomogeneities on short period geomagnetic variations.** Osella, A.M.

(Buenos Aires Univ. (Argentina). Facultad de Ciencias Exactas y Naturales). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/earth atmosphere; MAGNETIC STORMS/electric fields; BOUNDARY CONDITIONS; FOURIER ANALYSIS; GEOMAGNETIC FIELD; TIME DEPENDENCE

1645 (INIS-BR–1624, pp. 55) **Signature of the equatorial ring current in the ground level geomagnetic field within the southern polar cap.** Zelle, M.A. van (Buenos Aires Univ. (Argentina). Facultad de Ciencias Exatas y Naturales); Schneider, O. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GEOMAGNETIC FIELD/antarctic regions; GEOMAGNETIC FIELD/ionosphere; IONOSPHERE

1646 (INIS-BR–1624, pp. 59) **Magnetic activity effects on range type spread-F and vertical plasma drifts at Fortaleza and Huancayo from ionosonde measurements.** Batista, I.S.; Abdu, M.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. PLASMA DRIFT/ionosondes; PLASMA DRIFT/spread f; SPREAD F/ionosondes; SPREAD F/plasma drift; MAGNETIC FIELDS; IONOSONDES

1647 (INIS-BR–1624, pp. 60-61) **Long-term laser radar observation of sporadic sodium layers at 23^{0}S: a correlative and statistical study.** Batista, P.P.; Clemesha, B.R.; Batista, I.S.; Simonich, D.M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SPORADIC E/radar; LASERS; SODIUM; RADAR

1648 (INIS-BR–1624, pp. 63) **Low-latitude F-region dynamical processes from atomic oxygen nightGlow emissions.** Bittencourt, J.A.; Sahai, Y. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. F REGION/airglow; F REGION/dynamics; OXYGEN/airglow; OXYGEN/f region; ELECTRON DENSITY; AIRGLOW; DYNAMICS; NIGHT SKY; OXYGEN

1649 (INIS-BR–1624, pp. 64) **F-region bubbles: effects of vertical plasma drifts.** Bonelli, E. (Rio Grande do Norte Univ., Natal, RN (Brazil). Dept. de Fisica); Medeiros, R.T. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. F REGION/bubbles; F REGION/magnetic storms; F REGION/plasma drift; PLASMA DRIFT/f region; PLASMA DRIFT/magnetic storms; BUBBLES; NIGHT SKY; TIME DEPENDENCE

1650 (INIS-BR–1624, pp. 65) **Relation between auroras observed below or at λ_{inv}=62 and polar coronal holes area.** Bravo, S. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Geofisicas); Otyaola, J. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. POLAR-CAP AURORAE/holes; MAGNETIC STORMS; HOLES; SUNSPOTS

1651 (INIS-BR–1624, pp. 66) **Low ionosphere electron density profiles for the Antartic and south Atlantic geomagnetic anomaly regions associated to PCA events.** Costa, A.M. da; Piazza, L.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/antarctic regions; MAGNETIC STORMS/electron density; MAGNETIC STORMS/ionosphere; IONOSPHERE; RADIOWAVE RADIATION; WAVE PROPAGATION

1652 (INIS-BR–1624, pp. 68) **TEC studies in Argentina.** Ezquer, R.G. (Universidad Nacional de Tucuman (Argentina)); Adler, N. de; Radicella, S. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. F REGION/electron density; F REGION/faraday effect; ARGENTINA; SOLAR ACTIVITY

1653 (INIS-BR–1624, pp. 69) **Simultaneous observations of the OI 5577NM, NaD, O_2 (0,1) and OH (9,4) nightglow emissions at 23^{0}S.** Fagundes, P.R.; Takahashi, H.; Teixeira, N. R.; Sahai, Y. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. PHOTOCHEMISTRY/airglow; PHOTOCHEMISTRY/mesosphere; DYNAMICS; PHOTOCHEMISTRY; AIRGLOW; MESOSPHERE; TEMPERATURE MEASUREMENT

1654 (INIS-BR–1624, pp. 70-71) **Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT.** Figueroa, D. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)); Kohl, H.; Hernandez, R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. GASES/strong-coupling model; IONOSPHERE/gases; IONOSPHERE/polar regions; THERMOSPHERE/gases; THERMOSPHERE/polar regions; ANISOTROPY; GASES; INCOHERENT SCATTERING; INTERACTIONS; IONOSPHERE; THERMOSPHERE

1655 (INIS-BR–1624, pp. 72) **Rocket measurements of the OI 557.7 NM and O_2 (0,0) 761,9 NM equatorial emissions.** Gobbi, D.; Takahashi, H.; Clemesha, B.R.; Batista, P.P. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. AIRGLOW/emission; AIRGLOW/photochemistry; AIRGLOW; EMISSION; PHOTOCHEMISTRY; ELECTROJETS; OXYGEN; PHOTOMETERS; ROCKETS

1656 (INIS-BR–1624, pp. 75) **Electron density decrease during geomagnetic storms observed by means of two different techniques.** Leme, N.M.P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais); Piazza, L.R.; Moura, M.S.M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON DENSITY/magnetic storms; IONOSPHERE/magnetic storms; IONIZATION; IONOSPHERE

1657 (INIS-BR–1624, pp. 76) **Equatorial F region electrodynamics.** Louro, A.A. (Buenos Aires Univ. (Argentina). Facultad de Ciencias Exatas y Naturales); Duhau, S.N. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. E REGION/electrodynamics; E REGION/electrojets; E REGION/f region; F REGION/e region; F REGION/electrodynamics; F REGION/electrojets; BOUNDARY CONDITIONS; ELECTRODYNAMICS; ELECTROJETS; ELECTRIC CURRENTS

1658 (INIS-BR–1624, pp. 77) **Ionospheric absorption cosmic noise observations in Antartic.** Medrano, R.A.; Abdu, M.A.; Batista, I.S.; Muralikrishna, P. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH MAGNETOSPHERE/antarctica; EARTH MAGNETOSPHERE/electron precipitation; EARTH MAGNETOSPHERE/radio noise; ABSORPTION; ANTARCTICA; MAGNETIC STORMS

1659 (INIS-BR–1624, pp. 78) **Sunrise in the ionospheric D-Layer and the total atmospheric ozone content.** Medrano-Balboa, R.A.; Batista, I.S.; Abdu, M.A.; Piazza, L.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. OZONE/d region; OZONE/quantity ratio; OZONE LAYER/ultraviolet radiation; OZONE

1660 (INIS-BR–1624, pp. 79) **Plasma bubble characteristics as observed by a rocket-borne langmuir probe and a high frequency capacitance probe.** Muraliikrishma, P.; Abdu, M.A.; Kantor, I.J.; Batista, I.S. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERE/plasma; IONOSPHERE/plasma diagnostics; PLASMA/bubbles; PLASMA/plasma diagnostics; ELECTRON DENSITY; IONOSPHERE; PLASMA; LANGMUIR PROBE; BUBBLES; ROCKETS

1661 (INIS-BR–1624, pp. 80) **Distributed currents in the equatorial ionosphere over South American and Indian subcontinents: a comparison.** Muralikrishna, P.; Medrono, R.A.; Sobral, J.H.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTROJETS/e region; ELECTROJETS/f region; ELECTROJETS; GEOMAGNETIC FIELD; INDIA; MAGNETIC STORMS; SOUTH AMERICA

1662 (INIS-BR–1624, pp. 81) **Mode of variation of the electrojet width with current intensity during the solstices.** Ozoema, P.C. (Anambra State Univ. of Technology, Enugu (Nigeria)); Onwemichili, C.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTROJETS/currents; ELECTROJETS; CURRENTS; REGRESSION ANALYSIS; SEASONAL VARIATIONS

1663 (INIS-BR–1624, pp. 82) **Overhead configurations of Equatorial Electrojet (EEJ) at different seasons.** Ozoemena, P.C. (Anambra State Univ. of Technology, Enugu (Nigeria)); Obike, O.J.; Owu, K.; Osakwe, L.O.; Nwokoye, A.; Asogwa, M.; Asibe, B. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTROJETS/currents; ELECTROJETS; CURRENTS; SEASONAL VARIATIONS

1664 (INIS-BR–1624, pp. 83) **Morphology of EEJ: - Possible horizontal and vertical profiles from satellites and rockets data of equatorial electrojet.** Ozoemena, P.C. (Anambra State Univ. of Technology, Enugu (Nigeria)); Onwumechili, C.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTROJETS/current density; ELECTROJETS

1665 (INIS-BR–1624, pp. 84) **Ionospheric responses over the brazilian territory to the magnetic storm of february 7-10,1986.** Paula, E.R. de; Sobral, J.H.A.; Abdu, M.A.; Kantor, I.J. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON DENSITY/ionosphere; ELECTRON DENSITY/magnetic storms; BRAZIL; IONOSPHERE

1666 (INIS-BR–1624, pp. 85) **VLF transmissions phenomena observed in the Anterctic peninsula.** Piazza, L.R. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais); Leme, N.M.P.; Kuntz, V.L.R.; Alvala, P.C.; Costa, A.M. da; Moura, M.S.M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON DENSITY/ionosphere; ELECTRON DENSITY/magnetic storms; MAGNETIC STORMS/long wave radiation; MAGNETIC STORMS/wave propagation; ANTARCTICA; IONOSPHERE; SEASONAL VARIATIONS

1667 (INIS-BR–1624, pp. 86) **Neutral wind control over plasma bubbles zonal velocites at Brazilian low latitudes.** Sobral, J.H.A.; Abdu, M.A.; Zamlutti, C.J. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERE/airglow; IONOSPHERE/wind; PLASMA/bubbles; PLASMA/ionosphere; BRAZIL; IONOSPHERE; AIRGLOW; WIND; PHOTOMETRY; PLASMA; BUBBLES

1668 (INIS-BR–1624, pp. 87) **Incoherent scatter detection of downward proton fluxes into the ionospheric F-region over Arecido during July 1986 solar minimum.** Sobral, J.H.A. (National Astronomy and Ionosphere Center, Arecibo, Puerto Rico (USA)); Zamiutti, C.J.; Paula, E. de; Abdu, M.A.; Sahai, Y.; Takahashi, H.; Burnside, R.G.; Gonzalez, S. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. HYDROGEN IONS/f region; INCOHERENT SCATTERING; SOLAR ACTIVITY

1669 (INIS-BR–1624, pp. 88) **Poleward propagation of postsunset ionospheric plasma depletions as detected through meridional scanning airglow (λ=630 nm) measurements in Brazil.** Sobral, J.H.A.; Nakamura, Y.; Abdu, M.A.; Muralikrishna, P.; Zambutti, C.J. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERE/plasma; IONOSPHERE/wave propagation; PLASMA/bubbles; PLASMA/ionosphere; AIRGLOW; BRAZIL; ELECTRODYNAMICS; IONOSPHERE; PLASMA; BUBBLES; VELOCITY

1670 (INIS-BR–1624, pp. 89) **Geomagnetic storm effects on radiowave absorption in the geomagnetic anomaly region.** Rao, K.R. (Fundacao Univ. Regional de Blumenau, SC (Brazil)); Pardo, P.M.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/d region; RADIOWAVE RADIATION/absorption; RADIOWAVE RADIATION/magnetic storms; ELECTRON PRECIPITATION; ABSORPTION; SOLAR ACTIVITY

1671 (INIS-BR–1624, pp. 90) **Thermospheric models: a short review.** Zamlutti, C.J. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. THERMOSPHERE/mathematical models; THERMOSPHERE/navier-stokes equations; STEADY-STATE CONDITIONS; THERMOSPHERE; TIME DEPENDENCE

1672 (INIS-BR–1624, pp. 94) **Secondary cosmic ray measurements in the stratosphere near Campinas, Brazil, and South Atlantic, Africa.** Martin, I.M. (Universidade Estadual de Campinas, SP (Brazil). Dept. de Raios Cosmicos); Van, N.A.B.; Turtelli Junior, A.; Quintao, D.A.; Stozhkov, Y.I. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. SECONDARY COSMIC RADIATION/stratosphere; BALLOONS; MAGNETIC STORMS; STRATOSPHERE; SOUTHERN HEMISPHERE

1673 (INIS-BR–1624, pp. 101) **Short period variation of cosmic ray intensity observed in the stratosphere.** Van, N.A.B. (Universidade Estadual de Campinas, SP (Brazil). Dept. de Raios Cosmicos); Martin, I.M.; Furtelli Junior, A.; Stozhkov, Yu. I.; Silvikin, V.V.; Fradkin, M.I. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. COSMIC RAY DETECTION/disturbances; COSMIC RAY DETECTION/stratosphere; DISTURBANCES; STRATOSPHERE; PRESSURE DEPENDENCE

1674 (INIS-BR–1624, pp. 102) **Observations of high-energy electrons in the stratosphere.** Van, N.A.B. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Martin, I.M.; Turtelli Junior, A.; Stoshkov, Yu. I.; Fradkin, M.I. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. COSMIC RAY FLUX/electron precipitation; COSMIC RAY FLUX/stratosphere; STRATOSPHERE; COUNTING RATES; RADIATION BELTS

1675 (INIS-BR–1624, pp. 103-104) **Study on atmospheric spectroscopy.** Vasquez, G.J. (Universidad Nacional Autonoma de Mexico, Mexico City. Laboratorio de Cuernavaca). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ATMOSPHERIC CHEMISTRY/earth atmosphere; ATMOSPHERIC CHEMISTRY/spectroscopy; SPECTROSCOPY; CHEMICAL ANALYSIS; EXCITATION; IONIZATION; MOLECULES; PRESSURE MEASUREMENT; SUPERSONIC TRANSPORT; TEMPERATURE MEASUREMENT

1676 (INIS-BR–1624, pp. 105) **Interaction of dust grains with space plasmas.** Afonso, G.B. (Parana Univ., Curitiba, PR (Brazil). Dept. de Fisica); Kai, L.; Sant'Anna, A.S.; Foryta, D.W.; Berleze, S.M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. COSMIC DUST/interactions; COSMIC DUST/mathematical models; PLASMA/interactions; PLASMA/mathematical models; INTERACTIONS; DEBYE LENGTH; ELECTRIC FIELDS; PLASMA

1677 (INIS-BR–1624, pp. 106) **Equations of conservation laws in the interplanetary collisionfree plasma.** Alexander, P.M. (Buenos Aires Univ. (Argentina). Facultad de Ciencias Exactas y Naturales); Duhan, S.N. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. COLLISIONS/earth atmosphere; COLLISIONS/mathematical models; ELECTRONS/collisions;

PLASMA/collisions; COLLISIONS; CONSERVATION LAWS; ELECTRONS; HEAT FLUX; PLASMA

1678 (INIS-BR–1624, pp. 107) **Two-beam BGK solution in an inhonogeneous magnetic field.** Aragao, R.F. (Brasilia Univ., DF (Brazil). Dept. de Fisica). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON BEAMS/acceleration; ELECTRON BEAMS/aurorae; ELECTRON BEAMS/magnetic fields; ION BEAMS/aurorae; ION BEAMS/magnetic fields; ACCELERATION; AURORAE

1679 (INIS-BR–1624, pp. 110) **Failed connexion between flares and geomagnetic storms.** Bravo, S. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Geofisica); Godinez, A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. MAGNETIC STORMS/disturbances; DISTURBANCES; SOLAR FLARES

1680 (INIS-BR–1624, pp. 112) **Periodicities in the atmospheric electric field measured at the South Atlantic geomagnetic Anomaly.** Dutra, S.L.G.; Gonzalez, A.L.C.; Gonzalez, W.D. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRIC FIELDS/magnetic storms; MAGNETIC STORMS/electric fields; FLUCTUATIONS; LEVELS; SOUTHERN HEMISPHERE

1681 (INIS-BR–1624, pp. 113) **Solar activity and EL Nino: the auroral connection.** Perez-Enriquez, R. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Geofisica); Mendoza, B.; Alvarez-Madrigal, M. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. RIVERS/auroral zones; RIVERS/seas; RIVERS/solar activity; SOLAR ACTIVITY/auroral zones; SOLAR ACTIVITY/rivers; RIVERS; SEAS

1682 (INIS-BR–1624, pp. 116) **Electromagnetic instability below the proton gyrofrequency in large β multicomponent plasmas.** Gomberoff, L. (Chile Univ., Santiago (Chile). Dept. de Fisica); Vega, P. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH MAGNETOSPHERE/heavy ions; EARTH MAGNETOSPHERE/high-beta plasma; EARTH MAGNETOSPHERE/wave propagation; COMPUTER CALCULATIONS; GYROFREQUENCY; PROTONS; ULTRALOW FREQUENCY RADIATION; W CODES

1683 (INIS-BR–1624, pp. 122) **Stratospheric electric fields due to electrified convective clouds.** Pinto, J.R.C.A.; Pinto Junior, O.; Gonzalez, W.D. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. STRATOSPHERE/clouds; STRATOSPHERE/electric fields; BALLOONS; CHARGE DISTRIBUTION; CURRENT DENSITY; LEVELS; STRATOSPHERE; CLOUDS

1684 (INIS-BR–1624, pp. 123) **Mesospheric ozone depletion due to electron precipitation at the South Atlantic Magnetic Anomaly during geomagnetic storms.** Pinto Junior, O.; Kirchhoff, V.W.J.H.; Gonzalez, W.D. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON PRECIPITATION/magnetic storms; ELECTRON PRECIPITATION/mesosphere; OZONE/electron precipitation; OZONE/mesosphere; OZONE/quantity ratio; MESOSPHERE; OZONE; SOUTHERN HEMISPHERE

1685 (INIS-BR–1624, pp. 124) **MHD simulation in space plasma.** Rios, V.H. (Universidad Nacional de Tucuman (Argentina). Facultad de Ciencias Exactas y Tecnologia); Manzano, J.R. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH MAGNETOSPHERE/plasma fluid equations; MAGNETOHYDRODYNAMICS/plasma fluid equations; FINITE DIFFERENCE METHOD; MAGNETOHYDRODYNAMICS; TWO-DIMENSIONAL CALCULATIONS

1686 (INIS-BR–1624, pp. 127) **Spaced-based free electron laser.** Serbeto, A. de P.B. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)); Chian, A.C.-L. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON BEAMS/free electron lasers; ELECTRON BEAMS/relativistic range; FREE ELECTRON LASERS/heating; FREE ELECTRON LASERS/ionosphere; COHERENT RADIATION; HEATING; IONOSPHERE; POWER TRANSMISSION; WIGGLER MAGNETS

1687 (INIS-BR–1624, pp. 129) **Trends in environmentally induced spacecraft anomalies.** Wilkinson, D.C. (World Data Center A for Solar-Terrestrial Physics, Boulder, CO (USA)); Allen, J.H. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ENERGY TRANSFER/interplanetary space; ENERGY TRANSFER/magnetic storms; SOLAR ACTIVITY/interplanetary space; SOLAR ACTIVITY/magnetic storms; PLASMA DENSITY

1688 (N–89-26727) **Auroral plasma waves.** Gurnett, D.A. Iowa Univ., Iowa City, IA (USA). Jan 1989. 61p. (NASA-CR–185449;NAS–1.26:185449;U-OF-IOWA–89-11;CONF-8807168–: International conference on auroral physics, Cambridge (UK), 11-15 Jul 1988). Available from NTIS, PC A04/MF A01.

A review is given of auroral plasma wave phenomena, starting with the earliest ground-based observations and ending with the most recent satellite observations. Two types of waves are considered, electromagnetic and electrostatic. Electromagnetic waves include auroral kilometric radiation, auroral hiss, ELF noise bands, and low-frequency electric and magnetic noise. Electrostatic waves include upper hybrid resonance emissions, electron cyclotron waves, lower hybrid waves, ion cyclotron waves and broadband

electrostatic noise. In each case, a brief overview is given describing the observations, the origin of the instability, and the role of the waves in the physics of the auroral acceleration region.

1689 **HF sideband generation in the ionosphere.** Noble, S.T. (Rice Univ., Houston, TX (USA)); Gordon, W.E.; Duncan, L.M.; Mccoy, J.E. *Radio Science (USA)*, 24: 265-269 (Jun 1989).

The temporal development of sidebands excited near sunrise by two strong HF waves separated by a few hertz is presented. Sidebands are not observed before sunrise when the ionospheric critical frequency is less than the heater frequency. As the ionospheric density increases following sunrise and overdense conditions are established, strong sidebands emerge. Even though these results favor a mechanism which phase modulates the reflected HF wave over one which first downconverts the HF power to ULF before exciting sidebands, it is possible that either mechanism could at times contribute to sideband production. 8 refs.

1690 **Nonlinear wave fronts and ionospheric irregularities observed by HF sounding over a powerful acoustic source.** Blanc, E. (CEA, Laboratoire de Detection et de Geophysique, Bruyeres-le-Chatel (France)); Rickel, D. *Radio Science (USA)*, 24: 279-288 (Jun 1989).

Different wave fronts affected by significant nonlinearities have been observed in the ionosphere by a pulsed HF sounding experiment at a distance of 38 km from the source point of a 4800-kg ammonium nitrate and fuel oil (ANFO) explosion on the ground. These wave fronts are revealed by partial reflections of the radio sounding waves. A small-scale irregular structure has been generated by a first wave front at the level of a sporadic E layer which characterized the ionosphere at the time of the experiment. The time scale of these fluctuations is about 1 to 2 s; its lifetime is about 2 min. Similar irregularities were also observed at the level of a second wave front in the F region. This structure appears also as diffusion on a continuous wave sounding at horizontal distances of the order of 200 km from the source. In contrast, a third front unaffected by irregularities may originate from the lowest layers of the ionosphere or from a supersonic wave front propagating at the base of the thermosphere. The origin of these structures is discussed. 14 refs.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 899, 902, 944, 945

1691 (AD-A-209665/9/XAB) **Analytical evaluation of the electrostatic potential for diatomic molecules.** Jones, H.W.; Etemadi, B.; Weatherford, C.A. Florida Agricultural and Mechanical Univ., Tallahassee, FL (USA). Dept. of Physics. 1988. 7p. Available from NTIS, PC A02/MF A01.

Pub. in International Jnl. of Quantum Chemistry: Quantum Chemistry Symposium (22nd), 497-502(1988).

The technique of expanding Lowdin alpha-functions in a Taylor series has been further developed and applied to the problem of the electrostatic potential due to H_2 with given 1s, 2s, 2p Slater-type orbitals. In contrast to other methods, the approach is completely analytic, and capable of arbitrary precision. The ultimate accuracy of our method is dependent upon the number of partial waves used; here by use of only 13 harmonics excellent results are achieved. The methods are readily generalized to larger molecules. The electron-molecule static interaction potentials is of central importance to calculations of cross sections for electron-molecule collisions. In this paper, using the diatomic hydrogen molecule of Fraga and Ransil, the authors introduce a fully analytic method and make a few comparisons with computer runs using the codes of Morrison and Schmid et al. They, as well as others, need numerical integrals for the potential. The authors analytical methods avoid cancellation errors and singularities by expanding the exponentials in the Lowdin alpha-functions, which are used to represent displaced orbitals in a spherical harmonic series.

1692 (DOE/ER/45190-2) **Fundamental properties of spin-polarized quantum systems: Technical progress report, November 1988-October 1989.** Silvera, I.F. Harvard Univ., Cambridge, MA (USA). 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45190. Order Number DE90001754. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The objective of this project is to deepen our knowledge of spin-polarized quantum systems, in particular atomic hydrogen. We are currently also developing methods to study spin-polarized electrons. The primary thrust is to observe Bose Einstein condensation (BEC) in a gas of hydrogen. Since the first stabilization of hydrogen by Silvera and Walraven a decade ago, the hope of achieving BEC has peaked and ebbed as experiments revealed unexpected behavior of his new quantum system. Currently there are several very promising approaches to BEC and we are aggressively developing some of these. We are developing the compressed bubble in high magnetic field technique, microwave trap and Lyman-alpha cooling in a trap. In addition we continue to study properties of hydrogen in contact with its environment, as detailed knowledge of the experimental properties of hydrogen is the key to successful manipulation of this system. 6 refs.

1693 (LA-11677-MS) **Core-level binding energy shifts of the light actinide tetrafluorides and dioxides.** Farr, J.D.; Cox, L.E. Los Alamos National Lab., NM (USA). Oct 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90001810. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The x-ray induced photoemission spectra for the core and valence levels of PuF_4 and NpF_4 are described. The binding energies observed are compared with previous measurements of the metals, tetrafluorides, and dioxides of other light actinides. Energy shifts from the metal show a nearly linear increase throughout the series Th-Pu as a consequence of the steady increase in the effective nuclear charge. Empirically derived x-ray photoelectron spectroscopy (XPS) sensitivity factors used in quantitative analysis for neptunium and plutonium were obtained. 11 refs., 5 figs., 3 tabs.

1694 (N-89-24889) **Introduction to dissociative recombination.** Guberman, S.L.; Mitchell, J.A. Institute for Scientific Research, Lexington, MA (USA); Institute for Scientific Research, Lexington, MA (USA). 1989. 13p. (NASA-CR-184950;NAS-1.26:184950). Available from NTIS, PC A03/MF A01.

Dissociative recombination (DR) of molecular ions with electrons has important consequences in many areas of physical science. Ab-initio calculations coupled with resonant scattering theory and multichannel quantum defect studies have produced detailed results illuminating the role of ion vibrational excitation, the quantum yields of the DR products, and the role of Rydberg states. The theoretical and experimental results are discussed.

1695 (PB-89-216162/XAB) **Semiclassical theory of polyatomic Infrared Multiphoton Processes, phase 1. Appendices A through C. Technical report (Final).** Swaminathan, P.K. Chemical Dynamics Corp., Upper Marlboro, MD (USA). Sep 1986. 110p. Available from NTIS, PC A06/MF A01.

The research program was designed to develop a new semiclassical theory of multiphoton excitation and dissociation of polyatomic molecules, including electronically inelastic effects. Electronic degrees of freedom were coupled to nuclear motion by use of a self-consistent eikonal approximation. The resulting theory involved Hamilton-like equations of motion. The theory is capable of producing state-to-state cross sections and includes phase interferences. Applications were made to methyl iodide in addition to one-dimensional models, establishing the numerical feasibility of the approach. A two-state electronically nonadiabatic model was implemented. Electronic inelasticity was introduced through the competition between the intrastate and interstate dipole couplings. The numerical study provided information on the system behavior as a function of field strength and system parameters.

1696 (PPPL-2654) **Charge states of high Z atoms in a strong laser field.** Susskind, S.M.; Valeo, E.J.; Oberman, C.R.; Bernstein, I.B. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90001820. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present a numerical solution of the Thomas-Fermi atom in the presence of a static electric field as a model of the adiabatic response of a heavy atom in the presence of a strong laser field. In

this semiclassical approach, we calculate the resulting charge state of the atom and its induced dipole moment after the field is turned on. Due to the scaling properties of the Thomas-Fermi approach, the resulting total atomic charge and dipole moment can be expressed as a universal function of the field. We compare our results with recent ionization experiments performed on noble gases using laser fields. 7 refs., 5 figs.

1697 (SAND–89-2191C) **Detuning ion hose with a time varying axial magnetic field.** Shokair, I.R. Sandia National Labs., Albuquerque, NM (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909216–2: DARPA/SDIO service annual charged particle beam review, Monterey, CA (USA), 18-21 Sep 1989). Order Number DE90000777. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It has been shown that a constant axial magnetic field does not affect the growth rate of the ion hose instability. However, if the field is allowed to vary in time, on the ion motion time scale, it is expected that particle orbits will be affected in a way that will result in a time varying beam wavelength. This can lead to detuning of the instability. Results of the rigid model with a time varying field of strength similar to the channel strength, show a significant decrease in the growth of the instability. Also, simulations using the BUCKSHOT code confirm the small effect of a steady magnetic field on hose growth and show a significant decrease in growth with a time varying field. 3 figs.

1698 (UCRL–100904) **L-shell photoabsorption spectroscopy for solid metals: Ti, V, Cr, Fe, Ni, Cu.** Del Grande, N.K. Lawrence Livermore National Lab., CA (USA). 13 Sep 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907130–5: 9. vacuum ultraviolet radiation conference, Honolulu, HI (USA), 17-21 Jul 1989). Order Number DE90001510. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Synchrotron radiation measurements of near-threshold and broad-range (400–1500 eV) absolute photoabsorption cross sections were made for five transition metals with ±10% overall uncertainties. Fine structure details of 2p-3d autoionizing resonances are shown with better than 1.0 eV resolution for solid metals: Ti, V, Cr, Fe, Ni, and Cu. Fine structure similar to what we measured can be produced using a multi-configuration Dirac Fock (MCDF) model if a statistical distribution is assumed for the initial atomic states. Calculations were performed in intermediate coupling with configuration interactions by Mau H. Chen. The results are compared with other experimental work and theoretical methodologies. 18 refs., 7 figs.

1699 (ZfK–584, pp. 127) **Basic characteristics of an Au-Si-liquid metal ion source.** Muehle, R. (Jena Univ. (German Democratic Republic). Sektion Physik); Machalett, F. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GOLD BASE ALLOYS/ion sources; SILICON ALLOYS/ion sources; ANGULAR DISTRIBUTION; ELECTRIC CONDUCTIVITY; HYSTERESIS; LIQUID METALS; MELTING POINTS; MICRO AMP BEAM CURRENTS; SPECIFICATIONS

1700 (ZfK–584, pp. 125) **Mass spectrometry of liquid metal ion sources.** Muehle, R. (Jena Univ. (German Democratic Republic). Sektion Physik); Machalett, F. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GOLD BASE ALLOYS/ion sources; ION SOURCES/mass spectroscopy; SILICON ALLOYS/ion sources; BEAM CURRENTS; ION PAIRS; LIQUID METALS; MAGNETIC FIELDS; MASS RESOLUTION; MASS SPECTROMETERS; PERFORMANCE TESTING; SPECIFICATIONS

1701 (ZfK–584, pp. 128) **Fortran programmes for the calculation of single-particle quantities in heavy-ion collisions in a two-center basis.** Milek, B. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short communication. HEAVY ION REACTIONS/e codes; HEAVY ION REACTIONS/single-particle modes; BOUND STATE; C CODES; COUPLING; FORTRAN; L CODES; NUMERICAL SOLUTION; OCCUPATION NUMBER; SCHROEDINGER EQUATION; VIRTUAL STATES; WAVE FUNCTIONS

1702 Digital image processing in flow visualization. Hesselink, L. (Depts. of Aeronautics/Astronautics and Electrical Engineering, Stanford Univ., Stanford, CA (US)). vp of Annual review of fluid mechanics. Volume 20, 1988. Lumley, J.L.; VanDyke, M.; Reed, H.L Annual Reviews Inc., Palo Alto, CA (1988).

Flow visualization results from the interactions between light and matter. Classical methods such as shadowgraphy, schlieren photography, and interferometry visualize variation in the index of refraction induced by changes in density, pressure, or temperature. Nonuniformities of these physical observables modify the phase of optical waves, rendered visible by free-space propagation (shadowgraphy), optical processing in the back focal plane of a lens (schlieren photography), or interference with a reference wave (interferometry). The classical methods visualize variations of the index of refraction or spatial derivatives thereof integrated along the light path through the fluid. Three-dimensional space is projected onto a plane with the corresponding reduction in degrees of freedom. Except for axial symmetric or two-dimensional flows, spatial structures cannot be recovered from a single image.

1703 Data base of cross sections and reaction rates for hydrogen ion sources. Smith, K. (Los Alamos National Lab., NM (USA)); Glasser, A.H. *Computer Physics Communications (Netherlands),* 54(2/3): 391-407 (Jun-Jul 1989).

VAX 11/750; Fortran-77.

Many laboratories are building and operating hydrogen ion sources that generate intense beams, some with the requirement of low emittance. To optimize the design of these sources, several groups have embarked on writting computer models. All models require reaction rates among the numerous constituent species of the hydrogen plasma. HIONDAT is a suite of programs to create, update and use a data base of such reaction rates. (orig.).

1704 Dynamics of resonances rapidly shifting under short laser pulses. Tang, X. (Department of Physics, University of Southern California, Los Angeles, California 90089-0484 (US)); Lyras, A.; Lambropoulos, P. *Physical Review Letters (USA),* 63(9): 972-975 (28 Aug 1989).

We present a theoretical analysis of multiphoton ionization through intermediate states shifted through resonance during a short intense pulse. The dynamical behavior is described in terms of a density matrix evolving under a realistic temporal and spatial pulse shape. Our results, on atoms and with realistic parameters, show structure similar to that observed in recent experiments and suggest further interesting phenomena.

1705 Resonantly enhanced above-threshold ionization of helium. Perry, M.D. (Lawrence Livermore National Laboratory, Post Office Box 808, L-473, Livermore, California 94550 (US)); Szoke, A.; Kulander, K.C. *Physical Review Letters (USA),* 63(10): 1058-1061 (4 Sep 1989).

The role of multiphoton resonances in the above-threshold ionization of helium at intensities above 10^{14} W/cm^{-2} is investigated by both theory and experiment from 280 to 297 nm. Strong enhancement is observed in above-threshold ionization electron spectra and is attributed to five- and six-photon resonances to the $1s2p$ and $1s3d$, respectively. Numerical solution of the time-dependent Schroedinger equation predicts asymmetric resonance profiles with positions and ionization rates which are in good agreement with experiment.

1706 Isotopically selective optical deflection of a krypton atomic beam. Janik, G.R. (Battelle Pacific Northwest Laboratories, MS K3-57, P.O. Box 999, Richland, Washington 99352 (US)); Cannon, B.D.; Ogorzalek-Loo, R.; Bushaw, B.A. *Journal of the Optical Society of America B: Optical Physics (USA),* 6(9): 1617-1623 (Sep 1989). DOE Contract AC06-58RL01268.

We deflected a well-collimated beam of krypton atoms in the metastable $1s_5$ state by radiation pressure from a single-frequency dye laser. To produce the radiation pressure, we resonantly excited the krypton atoms, using the $1s_5$–$2p_9$ transition. The natural width of this transition is much smaller than its isotope shift, which allowed us to deflect one isotope at a time. This created a new isotopically enriched atomic beam of Kr($1s_5$). We achieved a maximum enrichment factor of 1.2×10^4 at a deflection angle of 19 mrad. This enrichment is limited mainly by scattering of the parent atomic beam by residual gas. This degree of enrichment may make it possible to perform sensitive measurements of the concentrations of rare krypton isotopes in environmental samples.

1707 Charge exchange effects in ion diodes. Pointon, T.D. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)). *Journal of Applied Physics (USA),* 66(7): 2879-2887 (1 Oct 1989). DOE Contract AC04-76DP00789.

A new one-dimensional particle simulation code has been developed to investigate the effect of charge exchange between the ions and background neutrals in a planar anode-cathode gap. The code has been used to study the effect of beam ions charge exchanging with neutrals in the anode plasma in an ion diode. Charge exchange creates a fast neutral population which expands into the gap much faster than the anode plasma itself. This flux quickly increases the neutral density throughout the gap. Furthermore, multiple charge exchanges reduce the ion flux and mean energy, and broaden the ion beam energy distribution. A description of the code and quantitative results of these effects are presented.

1708 The effect of charge exchange processes on ion diode impedance. Desjarlais, M.P. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)). *Journal of Applied Physics (USA),* 66(7): 2888-2893 (1 Oct 1989). DOE Contract AC04-76DP00789.

A simple model of the effect of charge exchange processes on the steady-state ion current in a space-charge-limited ion diode is presented. The model is used to investigate the effect of charge exchange processes on ion diode impedance and virtual cathode motion.

1709 Electron-impact cross sections and coherence parameters for the $6s^2\ ^1S$–$6s6p\ ^1P$ transition in neutral barium. Clark, R.E.H. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Abdallah, J. Jr.; Csanak, G.; Kramer, S.P. *Physical Review [Section] A: General Physics (USA),* 40(6): 2935-2949 (15 Sep 1989).

Integral and differential cross sections and electron-impact coherence parameters have been calculated for the $6s^2\ ^1S$–$6s6p\ ^1P$ transition in neutral barium using both the distorted-wave approximation and first-order many-body theory. Target-state wave functions have been calculated using Hartree-Fock orbitals along with configuration-interaction and intermediate-coupling mixing. Results are presented for electron-impact energies of 5, 10, 15, 20, 30, 40, 60, 80, and 100 eV. The cross sections are compared to available experimental and theoretical results.

1710 Transfer excitation processes in ion-atom collisions at high energies. Hahn, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268 (US)). *Physical Review [Section] A: General Physics (USA),* 40(6): 2950-2957 (15 Sep 1989).

A theory of ion-atom and ion-molecular collisions at high energies is formulated in which the projectile ions undergo simultaneous electron transfer and excitation (TE). A unified description of both resonant and nonresonant processes is presented. The resonant mode (RTE) is mediated by one of the target electrons, which excites the projectile and at the same time is captured by the projectile ion, thus forming a doubly excited intermediate state of the projectile ion. In the impulse approximation, this is related to the dielectronic recombination process in electron-ion collisions. The same doubly excited states can also be formed by one of the target electrons and the target core, interacting with the projectile ion in which the target core does the exciting and the electron is simply transferred. This is a nonresonant process (NTE), although the projectile is again left in a doubly excited state. We propose here still another mechanism for the formation of doubly excited states, UTE. The new process involves two target electrons in a nonresonant way, just as in the NTE, such that the electron that excites the projectile is left in the continuum, as viewed in the projectile rest frame. Some of the experimental evidence for these reactions is discussed.

1711 Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles. Schneider, D. (Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); DeWitt, D.; Schlachter, A.S.; Olson, R.E.; Graham, W.G.; Mowat, J.R.; DuBois, R.D.; Loyd, D.H. *Physical Review [Section] A: General Physics (USA),* 40(6): 2971-2975 (15 Sep 1989). DOE Contract W-7405-ENG-48.

Doubly differential cross sections have been measured as a function of the electron energy and observation angle for electron emission following collisions of 6-MeV/u U^{38+} and Th^{38+} on He and Ar. The electron-emission data show an enhancement at forward angles and a decrease at backward angles with respect to scaled-cross-section results based on the Born approximation. Comparison with classical-trajectory Monte Carlo calculations suggests that the deviation from the Born approximation can be explained by continuum-continuum couplings. By comparing with previously published data, we found that the forward enhancement as well as the backward decrease follow a q/v_p (q,v_p are the projectile charge and velocity) scaling.

1712 Accurate *ab initio* calculation on the low-energy elastic scattering of electrons from helium. Saha, H.P. (Department of Physics, University of Central Florida, Orlando, FL 32816-0993 (US)). *Physical Review [Section] A: General Physics (USA),* 40(6): 2976-2990 (15 Sep 1989).

The multiconfiguration Hartree-Fock method developed by Saha [Phys. Rev. A 39, 5048 (1989)] to study scattering of electrons from atoms has been applied to the low-energy elastic scattering of electrons from helium atoms. The short-range electron correlation and the long-range dynamical polarization of the target by the scattering electron, which are very important in these calculations, have been taken into account in an accurate *ab initio* manner through the configuration-interaction procedure. Detailed results for phase shifts, elastic differential, integral-elastic, and momentum-transfer cross sections for electrons elastically scattered from helium are reported for the low and intermediate energies ranging from 0.58 to 50 eV. The present results are compared with accurate experimental measurements and theoretical calculations. It is found that the present multiconfiguration self-consistent-field method produces high-quality results that show excellent agreement with experimental measurements and compare well with other accurate theoretical calculations.

1713 Angular and polarization correlations in photoionization and radiative recombination. Scofield, J.H. (Theoretical Atomic Physics Group, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)). *Physical Review [Section] A: General Physics (USA),* 40(6): 3054-3060 (15 Sep 1989). DOE Contract W-7405-ENG-48.

The relativistic formulation is given for the angular distribution of the electrons produced in the photoionization by linearly polarized photons and the distribution of photons of a particular polarization produced in the inverse process of radiative recombination. The electrons are treated as moving in a self-consistent Hartree-Slater central potential. Results are given for the radiative recombination

onto heliumlike nickel and neonlike barium for electrons in the energy range below 100 keV.

1714 **Spin effects in slow (H-He)$^+$ collisions.** Hippler, R. (Fakultaet fuer Physik, Universitat Bielefeld, Postfach 8640, Universitaetsstrasse 25, D-4800 Bielefeld 1, Federal Republic of Germany (DE)); Madeheim, H.; Lutz, H.O.; Kimura, M.; Lane, N.F. *Physical Review [Section] A: General Physics (USA),* 40(6): 3446-3449 (15 Sep 1989).

The integral alignment A_{20} was investigated for H(2*p*) excitation in slow (H-He)$^+$ collisions. Pronounced differences are observed between H$^+$-He and He$^+$-H collisions; they are attributed to the different (singlet and triplet) spin channels which dominate the respective excitation process.

1715 **Geometries and energy separations of 14 electronic states of Au_4.** Balasubramanian, K. (Department of Chemistry, Arizona State University, Tempe, Arizona 85287-1604 (US)); Feng, P.Y.; Liao, M.Z. *Journal of Chemical Physics (USA),* 91(6): 3561-3570 (15 Sep 1989).

Multiconfiguration SCF (MCSCF) followed by multireference configuration interaction calculations are carried out on 14 electronic states of Au_4 . The low-lying electronic states are studied further using multireference singles + doubles CI (MRSDCI) calculations including excitations from the *d* shells. The ground state of Au_4 is found to be a closed shell $^1A_1$ state with an equilibrium geometry of rhombus. Two excited states of $^3B_2$ symmetry with rhombus and square geometries were found to lie 0.98 and 1.12 eV above the ground state. The spin–orbit effects were included using the relativistic configuration interaction method (RCI). Accurate MRSDCI calculations which included up to 1.5 million configurations on the ground states of Au_2 and Au_3 are also performed with the objective of comparing the binding energies of Au_2 –Au_4 . The gold tetramer is found to be much more stable in comparison to the trimer and dimer.

1716 **Sporadicity: Between periodic and chaotic dynamical behaviors.** Gaspard, P. (Universite Libre de Bruxelles, Brussels (Belgium)); Wang, X..J. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(13): 4591-4595 (Jul 1988).

The authors define the class of sporadic dynamical systems as the systems where the algorithmic complexity of Kolmogorov and Chaitin as well as the logarithm of separation of initially nearby trajectories grow as $n^{v_0}(\log n)^{v_1}$ with $0 < v_0 < 1$ or $v_0 = 1$ and $v_1 < 0$ as time $n \rightarrow \infty$. These systems present a behavior intermediate between the multiperiodic ($v_0 = 0$, $v_1 = 1$) and the chaotic ones ($v_0 = 1$, $v_1 = 0$). They show that intermittent systems of Manneville as well as some countable Markov chains may be sporadic and, furthermore, that the dynamical fluctuations of these systems may be of Levy's type rather than Gaussian.

6404 Fluid Physics

Refer also to citation(s) 972, 1002, 1685, 1702, 1877

1717 (N–89-17445) **Flux Jacobian matrices and generalized Roe average for an equilibrium real gas.** Vinokur, M. Sterling Federal Systems, Inc., Palo Alto, CA (USA). Dec 1988. 19p. (NASA-CR–177512;NAS–1.26:177512). Available from NTIS, PC A03/MF A01.

Inviscid flux Jacobian matrices and their properties used in numerical solutions of conservation laws are extended to general, equilibrium gas laws. Exact and approximate generalizations of the Roe average are presented. Results are given for one-dimensional flow, and then extended to three-dimensional flow with time-varying grids.

1718 (PB–89-860514/XAB) **Cold nuclear fusion and muon-catalyzed fusion. January 1976-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1976-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 52p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning experiments and research in a type of nuclear fusion process which occurs at lower temperatures and pressures than conventional fusion reactions. The references describe theoretical and experimental results for a proposed muon-catalyzed fusion reactor, and for studies on muon sticking and reactivation, temperature dependence of fusion rates, and resolution of some engineering challenges. (Contains 82 citations fully indexed and including a title list.)

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 1201, 1697, 1751, 1767

1719 (ANL-HEP-CP–89-53) **The τ one-prong problem and recent measurements by the HRS [High Resolution Spectrometer] collaboration.** Repond, J. Argonne National Lab., IL (USA). 22 May 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8903132–10: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs (France), 5-12 Mar 1989). Order Number DE90002250. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We summarize recent measurements by the HRS collaboration of the topological branching fractions, the production cross section, the lifetime, and the rate into electrons of the τ lepton. An inconsistency with theoretical expectations persists at the level of two standard deviations. 11 refs., 2 figs., 4 tabs.

1720 (ANL-HEP-CP–89-60) **Jets, W's, and Z's at $\sqrt{s}$ = 1.8 TeV.** Kuhlmann, S.E. The CDF Collaboration. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8903143–6: 24. Recontres de Moriond: new results in hadronic interactions, Les Arcs (France), 12-18 Mar 1989). Order Number DE90002277. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Jet production and electroweak vector boson production have been observed in proton-antiproton collisions at the Fermilab Tevatron Collider. The inclusive jet cross section has been measured for jets up to transverse energies of 400 GeV, and is compared to QCD predictions. W and Z particle production has been observed and studies of their masses are described. 3 refs., 4 figs.

1721 (ANL-HEP-CP–89-102) **Getting maximum information from incomplete data on B $\rightarrow$ charmonium-K_S decays.** Lipkin, H.J. Argonne National Lab., IL (USA). 18 Sep 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8909233–1: Workshop on towards establishing b factory, Syracuse, NY (USA), 6-9 Sep 1989). Order Number DE90001438. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Tests of CP violation using B decays into CP eigenstates can be improved by using events normally rejected because of incomplete information. A search for lepton asymmetry in decays $\Upsilon(4S) \rightarrow B + \bar{B} \rightarrow (K_S + J/\psi) + (\text{lepton}^{\pm} + X)$ can be improved by including other $(c\bar{c})K_S$ events where the $(c\bar{c})$ pair is not bound in a J/ψ but in some other state like ψ' or η_c and where the lepton asymmetry is predicted to be the same as for $(K_S + J/\psi)$, other $(c\bar{c})K_S$ events which are not fully reconstructed and $(c\bar{c})K_L$ events where the K_L pair is not detected and which are predicted to have the opposite lepton asymmetry from corresponding K_S events. The information from these additional events can give improved statistics if suitable cuts can be found to improve signal/noise. The opposite asymmetry predicted for K_L events can test spurious lepton asymmetries due to systematic errors. 3 refs.

1722 (BONN-IR–88-55) **Studies on the hard scattering in photon-proton reactions in the energy range from 65 to 175 GeV at the CERN Ω spectrometer.** Rotscheidt, H. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1988. 120p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The measurement of multiparticle hadronic final states produced with a tagged photon beam on a hydrogen target was analysed in the range of large transverse momentum. The basic method to identify such events is described here. A comparison to hadron induced data, taken with the same apparatus, indicates a relative excess of particles with p_t>1.6 GeV/c for the photon induced data

which is quantitatively consistent with the predicted distribution of pointlike photon interactions. (orig.).

1723 (BONN-IR-89-07) **Comparison between photo- and hadroproduction of rho^0 mesons at the CERN-OMEGA spectrometer.** Joseph, D. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. 1989. 205p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

A comparison is made between inclusive production of rho^0 mesons in γp and h^{+-}p collisions with beam energy of $65 \leq E_\gamma \leq 175$ and E_h=80, 140 GeV. The data were obtained with 6.10^6 γ-events and 6.2.10^6 hadron induced events. The ratio of production cross sections is studied with respect to $x_F(-0.1 \leq x_F \leq 1)$ and $p_{perpendicular\ to} 0. \leq p_{perpendicular\ to} \leq 1.4$ GeV/c. In kinematic domain of central production where no effects due to the different quantum numbers of beamphotons and -hadrons are expected the author observes within the errors an x_F and $p_{perpendicular\ to}$ independent ratio as predicted by Vector Meson Dominance. The forward part ($x_F \geq 0.8$) of inclusive rho^0 photoproduction is described by phenomenological predictions based on the triple regge mechanism and Vector Meson Dominance. Non diffractive photoproduction and hadronproduction can be described by quark-antiquark fusion models is a x_F range between 0.2 and 0.8 GeV. At smaller x_F-values (x_F<0.2) the cross sections predicted by these models are considerably bigger than the measured values. (orig.).

1724 (ISN-89-12) **Constituent approach to high energy elastic scattering of hadrons.** Furget, C.; Buenerd, M. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. Jan 1989. 13p. (CONF-8903172--: 10. two-yearly meeting on nuclear physics, Aussois (France), 6-10 Mar 1989). Order Number DE90713771. Available from NTIS (US Sales Only), PC A03/MF A01.

The work reported here describes a phenomenological approach to the hyperon-nucleon cross-section. This latter work has been undertaken in the context of the experiment WA89 at CERN which will offer the unique opportunity of measuring these cross-sections over the center of mass energy domain $\sqrt{s}$ = 20 +- 5 GeV.

1725 (Juel-Spez-501) **Baryon-baryon interaction and dibaryonic systems. Review and perspectives.** Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1988. 579p. (CONF-8806440--: International workshop on baryon-baryon interaction and dibaryonic systems, Bad Honnef (Germany, F.R.), 13-16 Jun 1988). Available from Available from Kernforschungsanlage Juelich GmbH (Germany F.R.). Zentralbibliothek.

The workshop on 'Baryon-Baryon Interaction and Dibaryonic Systems' was held in the Physikzentrum Bad Honnef, June 13-16, 1988. It provided an informal setting for lively discussions and exchange of ideas between experimentalists and theoreticians working in the field. The topics covered ranged from (lack of) evidence for narrow dibaryonic structures via few particle systems with electromagnetic probes, nucleon-nucleon scattering up to nucleon-antinucleon scattering and strange dibaryonic systems. If the workshop could be summarized at all, it would be by stating that, although there seems to be sufficient experimental material and a fair agreement on its theoretical interpretation as far as low-energy phenomena (i.e. up to the region of the Δ(1232)-resonance excitation) is concerned, the really challenging area involving composite hadronic systems at higher excitation energies is still mainly 'terra incognita'. This compilation contains copies of transparancies used at the workshop. They were collected and summarized in keywords by Bjoern Feldkeller and Michael Fuchs, whose assistance otherwise is also greatly acknowledged. (orig.).

1726 (LAPP-EXP-88-11) **Neutrinos, dark matter and low temperature detectors.** Gonzalez-Mestres, L.; Perret-Gallix, D. Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules. 1988. 34p. (CONF-8805212--: 2. European workshop on low temperature devices for the detection of low energy neutrinos and dark matter, Annecy (France), 2-6 May 1988). Order Number DE90713781. Available from NTIS (US Sales Only), PC A03/MF A01.

The present status of cryogenic detector developments for particle physics is discussed, with emphasis on applications at the cross-disciplinary frontier between particle physics and astrophysics, where low temperature devices appear to be particularly well suited. The overwiew of results is completed by a sketch of new ideas and possible ways for further improvements. Neutrino role importance is particularly shown.

1727 **Measurement of α_s from hadron jets in e^+e^- annihilation at $\sqrt{s}$ of 29 GeV.** Ford, W.T. (Department of Physics, University of Colorado, Boulder, Colorado 80309 (US)); Qi, N.; Read, A.L. Jr.; Smith, J.G.; Camporesi, T.; De Sangro, R.; Peruzzi, I.; Piccolo, M.; Hurst, R.B.; Pyrlik, J.; and others. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1385-1396 (1 Sep 1989).

A study of the lateral development of jets of hadrons produced in electron-positron annihilation has been used to determine the strong coupling constant α_s. Data were obtained with the MAC detector at the SLAC e^+e^- storage ring PEP at $\sqrt{s}$ =29 GeV. Based on the parton calculations of Gottschalk and Shatz, a value for α_s of $0.133 \pm 0.005(\text{stat}) \pm 0.009(\text{syst})$ has been determined for string fragmentation, and $0.112 \pm 0.008(\text{stat}) \pm 0.007(\text{syst})$ for an independent-jet model.

1728 **New measurement of the production polarization and magnetic moment of the Ξ^- hyperon.** Trost, L.H. (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242 (US)); McCliment, E.R.; Newsom, C.R.; Hsueh, S.Y.; Muller, D.; Tang, J.; Winston, R.; Zapalac, G.; Swallow, E.C.; Berge, J.P.; and others. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1703-1707 (1 Sep 1989).

We have measured the production polarization and magnetic moment of a sample of 89×10^3 Ξ^- hyperons produced in the inclusive reaction p(400 GeV/c)+Cu$\rightarrow\Xi^-$+X. The weighted average of the polarization is $-0.070 \pm 0.008 \pm 0.010$ at a p_t of 0.63 GeV/c. The Ξ^-'s magnetic moment yields the value $\mu_{\Xi^-} = -0.661 \pm 0.036 \pm 0.036$ nuclear magnetons. The first error is statistical, the second systematic.

1729 **Measurement of a mixed spin-spin correlation parameter for *np* elastic scattering.** Garnett, R. (Argonne National Laboratory, Argonne, Illinois 60439 (US)); Rawool, M.; Carlson, V.; Hill, D.; Johnson, K.F.; Lopiano, D.; Ohashi, Y.; Shima, T.; Spinka, H.; Stanek, R.; and others. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1708-1711 (1 Sep 1989). DOE Contract W-31109-ENG-38;AS05-76ER04449;AS04-76ER03591;FG05-

The mixed spin-spin correlation parameter $C_{\sigma\sigma} \approx 0.5C_{SS} - 0.8C_{SL}$ for *np* elastic scattering was measured for incident-neutron-beam kinetic energies of 484, 634, and 788 MeV over the center-of-mass angular range 75°–180°. These $C_{\sigma\sigma}$ data are important for determining the I=0 nucleon-nucleon amplitudes and provide strong constraints on the phase-shift solutions. It was found that the $^1P_1$, $^3S_1$, and $^3D_1$ isospin-0 partial waves are most strongly affected.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 1568, 1612, 1721, 1725, 1767, 1771, 1773, 1804

1730 (ANL-HEP-CP-89-87) **The shell model approach: Key to hadron structure?.** Lipkin, H.J. Argonne National Lab., IL (USA). 14 Aug 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-890583--4: Symposium on the occasion of the 40th anniversary of the nuclear shell model, Argonne, IL (USA), 25-27 May 1989). Order Number DE90002212. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A shell model approach leads to a simple constituent quark model for hadron structure in which mesons and baryons consist only of constituent quarks. Hadron masses are the sums of the constituent quark effective masses and a hyperfine interaction inversely proportional to the product of these same masses. Hadron masses and magnetic moments are related by the assumption that the same effective mass parameter appears in the additive mass term, the hyperfine interaction, and the quark magnetic moment, both in mesons and baryons. The analysis pinpoints the physical assumptions needed for each relation and gives two new mass relations.

Application to weak decays and recent polarized EMC data confirms conclusions previously obtained that the current quark contribution to the spin structure of the proton vanishes, but without need for the questionable assumption of SU(3) symmetry relating hyperon decays and proton structure. SU(3) symmetry breaking is clarified. 24 refs.

1731 (ANL-HEP-CP-89-104) **Confinement and the Pomeron.** White, A.R. Argonne National Lab., IL (USA). 25 Sep 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8905208-2: 3. international conference on elastic and diffractive scattering, Evanston, IL (USA), 2-6 May 1989). Order Number DE90001417. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The importance of confinement for obtaining a unitary high-energy limit for QCD is discussed. "Minijets" are argued to build up non-unitary behavior–when $k_T > \Lambda$ is imposed. For minijets to mix with low k_T Pomeron Field Theory describing confinement, and give consistent asymptotic behavior, new "quarks" must enter the theory above the minijet transverse momentum scale. The Critical Pomeron is the resulting high-energy limit. 22 refs.

1732 (ANL-HEP-CP-89-107) **Phenomenology of heavy quark production.** Berger, E.L. Argonne National Lab., IL (USA). 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8906199-3: 9. international conference on physics in collision, Jerusalem (Israel), 19-21 Jun 1989). Order Number DE90002207. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A review is presented of heavy quark production in $\bar{p}p$, π^-p, and pp interactions at fixed target and collider energies. Calculations of total cross sections and of single quark inclusive differential cross sections $d^2\omega/dk_T dy$ are described including contributions through next-to-leading order in QCD perturbation theory. Comparisons with available data on charm and bottom quark production show good agreement for reasonable values of the charm and bottom quark masses and other parameters. Predictions and open issues in the interpretation of results are summarized. A brief discussion is presented of signatures, backgrounds, and expected event rates for top quark production. 24 refs., 6 figs.

1733 (BNL–42892) **CP violation in $K_L \rightarrow \pi^0 e^+ e^-$.** Littenberg, L.S. Brookhaven National Lab., Upton, NY (USA). [1989]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891161–1: CP violation at KAON Factory conference, Vancouver (Canada), 30 Nov - 3 dec 1989). Order Number DE89015074. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It's been appreciated for many years that the decays $K_L \rightarrow \pi^0 \ell\bar{\ell}$ are CP violating to lowest order in the Standard Model, and that the component of direct CP violation in these decays is likely to be comparable to that of the CP violation due to state mixing (ϵ). This is to be contrasted with the case of $K^0 \rightarrow \pi\pi$ wherein the latter contribution is predicted to be hundreds of times larger than the former. This paper investigates this CP violation further. 19 refs., 2 figs.

1734 (GSI–89-67(prepr.)) **Space-time effects in the decay of strings by pair-creation.** Herrmann, M.; Knoll, J. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Sep 1989. 11p. Order Number DE90718233. Available from NTIS (US Sales Only), PC A03/MF A01.

To overcome certain deficiencies of the Schwinger pair-creation formula as used in string break up models we calculate the production rate in finite time-dependent electric field configurations. For computational reasons we look for analytic solutions of the dynamics. This we have achieved in the case of massless fermions in 1+1 dimension. The pathological nature of this case forces us to look at special field configurations or to use a small mass approximation. In both situations we find a suppression of the production rate for small space-time volumes available for pair production. (orig.).

1735 (JINR-E–4-88-917) **Photoproduction of pions off nucleons and nuclei.** Chumbalov, A.A.; Eramzhyan, R.A.; Kamalov, S.S. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 15p. (CONF-880938–6: International symposium on mesons and light nuclei, Rez (Czechoslovakia), 5-10 Sep 1988). Order Number DE90000523. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

Present status of pion photoproduction on nucleons and nuclei is discussed. Transitions on bound nuclear states in charged pion photoproduction and the coherent processes in neutral pion photoproduction are examined from the point of view of self-consistent description of all theory ingredients. 36 refs., 5 figs.

1736 (JINR-E–4-89-11) **Theoretical aspects of pion photoproduction off light nuclei.** Chumbalov, A.A.; Eramzhyan, R.A.; Kamalov, S.S. Joint Inst. for Nuclear Research, Dubna (USSR). 1989. 15p. (CONF-8811171–6: 17. INS international symposium on nuclear physics at intermediate energies, Tokyo (Japan), 15-17 Nov 1988). Order Number DE90000116. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

Present status of the pion photoproduction on free nucleons and nuclei is discussed. The coherent process in the neutral pion photoproduction is examined from the point of view of self-consistent description of all ingredients of the calculations. 23 refs., 4 figs., 4 tabs.

1737 (LA-UR–89-3426) **The creation of high energy densities with antimatter beams.** Gibbs, W.R.; Kruk, J.W. Los Alamos National Lab., NM (USA). [1989]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8906194–3: International meeting on physics at KAON, Bad Honnef (Germany, F.R.), 7-9 Jun 1989). Order Number DE90002383. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The use of antiprotons (and antideuterons) for the study of the behavior of nuclear matter at high energy density is considered. It is shown that high temperatures and high energy densities can be achieved for small volumes. Also investigated is the strangeness production in antimatter annihilation. It is found that the high rate of Lambda production seen in a recent experiment is easily understood. The Lambda and K-short rapidity distributions are also reproduced by the model considered. 11 refs., 6 figs.

1738 (LA-UR–89-3609) **Exchange currents in double charge exchange.** Oset, E.; Strottman, D.D.; Vicente-Vacas, M. Los Alamos National Lab., NM (USA). 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8908131–2: 2. LAMPF workshop on pion-nucleus double charge exchange, Los Alamos, NM (USA), 9-11 Aug 1989). Order Number DE90002419. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A revision is done of the role played by exchange currents in DCX pointing out the mechanisms that are likely to be important in certain reactions and kinematical regimes. 25 refs., 14 figs.

1739 (MPI-PAE/Exp.El.–211) **A new νanti ν + multiphoton generator derived from KORALZ.** Colas, P.; Mirabito, L.; Was, Z. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik. Sep 1989. 23p. Order Number DE90718231. Available from NTIS (US Sales Only), PC A03/MF A01.

We have extended the KORALZ program into a νanti ν + multiphoton generator. We compare the results to several other calculations, with several levels of approximation. Very good agreement is found, in all cases. This is especially interesting in the case of the comparison with NNGG03, an exponentiated second-order generator. This gives an insight on the effect of higher order corrections (three radiated photons or more) on the cross-section in standard experimental conditions. In this study, we also estimate the systematic uncertainties of the theoretical cross-section. (orig.).

1740 (N–89-17562) **BRYNTRN: A baryon transport model.** Wilson, J.W.; Townsend, L.W.; Nealy, J.E.; Chun, S.Y.; Hong, B.S.; Buck, W.W.; Lamkin, S.L.; Ganapol, B.D.; Khan, F.; Cucinotta, F.A. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Mar 1989. 84p. (NASA-TP–2887;L–16512;NAS–1.60:2887). Available from NTIS, PC A05/MF A01.

The development of an interaction data base and a numerical solution to the transport of baryons through an arbitrary shield material based on a straight ahead approximation of the Boltzmann equation are described. The code is most accurate for continuous energy

boundary values, but gives reasonable results for discrete spectra at the boundary using even a relatively coarse energy grid (30 points) and large spatial increments (1 cm in H2O). The resulting computer code is self-contained, efficient and ready to use. The code requires only a very small fraction of the computer resources required for Monte Carlo codes.

1741 **On the scattering function of simple fluids in finite systems.** Mansour, M.M. (Universite Libre de Bruxelles, Brussels (Belgium)); Garcia, A.L.; Turner, J.W.; Mareschal, M. *Journal of Statistical Physics (USA),* 52(1-2): 295-309 (Jul 1988). DOE Contract AS05-81ER10947.

The density-density dynamical correlation function of a simple fluid in a finite container subject to a constant temperature difference is explicitly obtained. In small systems, such as those realized in computer experiments, new peaks appear in the scattering spectrum, even at equilibrium, arising from standing waves produced by the fluctuations. Away from equilibrium, these peaks are asymmetric in the same manner as the Brillouin lines. The macroscopic limit is also considered and the correction to the usual infinite system approximation is explicitly obtained.

1742 **Testing QCD with milli-TeV electrons.** Close, F.E. (Oak Ridge National Lab., TN (USA)). *Nuclear Physics [Section] A (Netherlands),* 497: 497 (26 Jun 1989). DOE Contract AC05-84OR21400. (CONF-8806236--: 1. European workshop on hadronic physics in the 1990's with multi-GeV electrons, Seillac (France), 27 Jun - 1 jul 1988).

The author reviews the study of QCD in the non-perturbative regime by electromagnetic probes. Especially he considers the photoproduction of nucleonic resonances. (HSI).

1743 **Hierarchical chiral symmetry breaking and quark mass matrices revisited.** Albright, C.H. (Fermi National Accelerator Lab., Batavia, IL (USA)); Lindner, M. *Zeitschrift fuer Physik [Sektion] C: Particles and Fields (F.R. Germany),* 44(4): 673-679 (Nov 1989).

We demonstrate how the assumption of hierarchical chiral symmetry breaking can be systematically used to create phenomenologically satisfactory mass matrices. In place of postulating a particular set of mass matrices at the outset, we emphasize that once a particular basis for the first stage of chiral symmetry breaking is selected, the following steps are determined by the known information on quark masses and mixings. We illustrate this procedure for the basis originally chosen by Fritzsch and find a modified set of quark mass matrices, corresponding to equal final-stage nondiagonal radiative contributions, which fits the data much better in the minimal Higgs framework, provided $m_t \simeq 88$ GeV and the mixing ratio vertical strokeV_{ub}vertical stroke/vertical strokeV_{cb}vertical stroke$\simeq 0.15$. (orig.).

1744 **Routes to chaotic scattering.** Bleher, S. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742 and Departments of Electrical Engineering and of Physics, University of Maryland, College Park, Maryland 20742 (US)); Ott, E.; Grebogi, C. *Physical Review Letters (USA),* 63(9): 919-922 (28 Aug 1989).

The onset of chaotic behavior in a class of classical scattering problems is shown to occur in two possible ways. One is abrupt and is related to a change in the topology of the energy surface. The other arises as a result of a complex sequence of saddle-node and period doubling bifurcations. The abrupt bifurcation represents a new generic route to chaos and yields a characteristic scaling of the fractal dimension associated with the scattering function as $[\ln(E_c - E)^{-1}]^{-1}$, for particle energies E near the critical value E_c at which the scattering becomes chaotic.

1745 **Possible method in some extensions of the standard model to produce and detect Higgs bosons at hadron colliders.** del Aguila, F. (Departamento de Fisica Teorica, Universitat Autonoma de Barcelona, 08193 Bellaterra, Barcelona, Spain (ES)); Kane, G.L.; Quiros, M. *Physical Review Letters (USA),* 63(9): 942-944 (28 Aug 1989).

If an SU(2)-singlet quark (we call it D) with mass on the weak scale exists, for which there is some motivation, it can have a large decay to a normal quark plus a Higgs boson, e.g., $D \rightarrow b + H^0$. If $M_D \lesssim 150$ GeV, this converts present-day hadron colliders from being unlikely to detect Higgs bosons into useful Higgs boson factories, sensitive for $M_{H^0} \lesssim M_Z$.

1746 **Radiative quark and lepton masses in a left-right gauge model.** Ma, E. (Department of Physics, University of California, Riverside, California 92521-0413 (US)). *Physical Review Letters (USA),* 63(10): 1042-1045 (4 Sep 1989).

The conventional left-right gauge model based on the group $SU(3) \times SU(2)_L \times SU(2)_R \times U(1)$ is extended to include singlet quarks and leptons but the usual Higgs-boson doublet-doublet is replaced by two doublet-singlets and two singlet-doublets. As a result, realistic radiative masses for light quarks and leptons can be obtained. Neutrino masses are further suppressed by the seesaw mechanism. There is no need for any assumed discrete symmetry.

1747 **A global existence theorem for the nonlinear BGK equation.** Greenberg, W. (Virginia Polytechnic Institute and State Univ., Blacksburg (USA)); Polewczak, J. *Journal of Statistical Physics (USA),* 55(5-6): 1313-1321 (Jun 1989). DOE Contract FG05-87ER25033.

A global existence theorem with large initial data in L^1 is given for the nonlinear BGK equation. The method, which is based on the recent averaging lemma of Golse et al., utilizes a weak compactness argument in L^1.

1748 **Beam-polarization phenomena in high-energy e^+e^- collider physics.** Ward, B.F.L. (Department of Physics and Astronomy, The University of Tennessee, Knoxville, Tennessee 37996-1200 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1411-1423 (1 Sep 1989).

We consider the possible effects of a nontrivial initial-beam polarization in high-energy e^+e^- collider physics. Specifically, we address initial-beam-polarized production of possible new scalars and fermions. For definiteness, we take scalar leptons and scalar quarks as our typical new scalars and we take supersymmetric gauge-Higgs fermions as our typical fermions. In this way, we arrive at formulas which can be applied to any scalar and any fermion pair produced in lowest order in $e^+e^- \rightarrow A, Z^0 \rightarrow X$. We have in mind that our formulas will be used first at the SLAC Linear Collider (SLC) and the CERN collider LEP. Thus, we illustrate them in the SLC-LEP-type energy regime. Applications to the TeV Linear Collider and CERN Linear Collider are immediate and will be taken up elsewhere.

1749 **New-quark and -lepton production at high-energy e^+e^- colliders.** Rizzo, T.G. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1424-1429 (1 Sep 1989). DOE Contract AC02-76ER00881.

We compare and contrast production and decay signatures for several kinds of new quarks and leptons which may be produced at future high-energy e^+e^- colliders. Mirror, isodoublet and isosinglet vectorlike, and sequential fourth-generation fermions are considered along with the isotriplet lepton of Foot and co-workers. We find that total cross sections and forward-backward and left-right polarization asymmetries, combined with particular final-state decay signatures, can be used together to distinguish among these possible sets of new fermions at e^+e^- colliders.

1750 **Semihard QCD and high-energy pp and $\bar{p}p$ scattering.** Durand, L. (Department of Physics, University of Wisconsin-Madison, Madison, Wisconsin 53706 (US)); Pi, H. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1436-1445 (1 Sep 1989).

We present the results of an analysis of high-energy pp and $\bar{p}p$ scattering based on a model in which the energy dependence of very-high-energy processes is driven by semihard scatterings of quarks and gluons in the nucleons. We show in particular that parton-parton scattering processes at small x drive not only the observed increases in total, elastic-, and inelastic-scattering cross sections and the forward slope parameter, but also, through analyticity, a rapid increase in the ratio of the real to the imaginary part of the forward elastic-scattering amplitude. We also give a careful definition of the inclusive jet cross section and present results on σ_{jet}, average jet multiplicities, and jet-multiplicity fluctuations at high energies.

1751 Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?. Bengtsson, H. (University of California Los Angeles, Los Angeles, California 90024 (US)); Hauptman, J.; Linn, S.; Savoy-Navarro, A. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1465-1471 (1 Sep 1989). DOE Contract AT03-88ER40384.

Events with high-mass *W* pairs and corresponding backgrounds have been generated, realistically simulated, and analyzed to isolate the Higgs boson. The signature considered is one produced when one *W* decays leptonically while the other decays hadronically. Detection efficiencies are calculated for the case of an 800-GeV minimal Higgs boson. For the case of a top quark lighter than the *W*, the signal is observed with a statistical significance of two standard deviations after one year of simulated Superconducting Super Collider running with a luminosity of 10^{33} cm^{-2} s^{-1}. .AE

1752 Higgs bosons in left-right-symmetric models. Gunion, J.F. (Department of Physics, University of California at Davis, Davis, California 95616 (US)); Grifols, J.; Mendez, A.; Kayser, B.; Olness, F. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1546-1561 (1 Sep 1989).

In the context of minimal left-right-symmetric extensions of the standard $SU(2)_L \times U(1)$ model, four possible scenarios emerge depending upon the number of neutral Higgs fields that acquire nonzero vacuum expectation values. We examine these four scenarios in the case of a simple form for the scalar potential of the model. We find that by combining the minimization conditions appropriate to each of these scenarios with constraints coming from K_L-K_S mixing and the absence of flavor-changing neutral currents, two of the scenarios are ruled out. For the allowed scenarios rather definitive consequences for the Higgs sector can be obtained. For instance, several of the scalar bosons are forced to be very heavy by flavor-changing neutral-current constraints. Aside from the Higgs boson which plays the role of the standard-model Higgs fields, the three left-handed triplet members are most likely to be light. Indeed, in one of the vacuum-expectation-value scenarios they are forced to be light (the neutral member being massless at the tree level). We catalogue the constraints from low-energy experiments on a doubly charged Higgs triplet and a very light neutral Higgs triplet, when these couple to two leptons (as in the left-right model). Many of the constraints we obtain are new. A new lower bound on the W_R mass, related to the strength of these lepton-lepton couplings, is derived. The cross sections for these bosons are large out to masses of order several TeV and signatures for their decay are striking and essentially background-free.

1753 How well do we know the Kobayashi-Maskawa matrix?. Cudell, J.R. (Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge CB39EW, United Kingdom (GB)); Halzen, F.; Pakvasa, S. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1562-1568 (1 Sep 1989).

We evaluate the Kobayashi-Maskawa (KM) matrix using a maximum-likelihood method which takes into account experimental errors on input data and "systematic errors" associated with theoretical approximations. We carefully reconsider the constraints from meson decays and mixings as well as *CP* violation. We derive values for all matrix elements with errors smaller than 0.008, show that the ratio $|U_{ub}/U_{cb}|$ must be bigger than 0.036, and that the phase angle δ of the KM representation is smaller than π. Surprisingly our conclusions depend very weakly on the value of the top-quark mass. Any experiment violating the constraints of our fitted KM matrix would imply physics beyond the standard model with three generations and a minimal Higgs sector.

1754 Bounds on the mass of W_R and the W_L-W_R mixing angle ζ in general $SU(2)_L \times SU(2)_R \times U(1)$ models. Langacker, P. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104 (US)); Sankar, S.U. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1569-1585 (1 Sep 1989).

We consider the phenomenological constraints on the mass M_R and the W_L-W_R mixing angle ζ in a very general class of $SU(2)_L \times SU(2)_R \times U(1)$ models. In particular, almost no model-dependent assumptions are made concerning left-right symmetry or the Higgs structure of the theory, which means that U^R, the mixing matrix for right-handed quarks, is unrelated to the left-handed Cabibbo-Kobayashi-Maskawa matrix U^L. We consider a number of possibilities for the neutrinos occurring in right-handed currents, including (a) heavy Majorana neutrinos, (b) heavy Dirac neutrinos, (c) intermediate-mass (10–100 MeV) neutrinos, and (d) light neutrinos (e.g., the Dirac partners of the ordinary left-handed neutrinos). For each case we utilize relevant constraints from the K_L-K_S mass difference, $B_d\bar{B}_d$ oscillations, the *b* semileptonic branching ratio and decay rate, neutrinoless double-beta decay, theoretical relations between mass and mixing, universality, nonleptonic kaon decays, muon decay, and astrophysical constraints from nucleosynthesis and SN 1987A. As is to be expected the limits on M_R are considerably weaker than for the special case of manifest or pseudomanifest left-right symmetry (M_R>1.4 TeV). In fact, if extreme fine-tuning is allowed the W_R could be as light as the ordinary W_L. However, with reasonable restrictions on fine-tuning one obtains M_R>300 GeV for g_R=g_L, with more stringent limits holding for most of parameter space.

1755 Effects of diquarks and mesons on baryon magnetic moments. Lichtenberg, D.B. (Department of Physics, Indiana University, Bloomington, Indiana 47405 (US)); Namgung, W. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1606-1614 (1 Sep 1989).

We develop a formalism to describe baryon magnetic moments, including effects of diquark correlations and pseudoscalar-meson clouds in the baryon wave functions. The expressions for the magnetic moments involve overlap integrals of baryon spatial wave functions and the probability amplitudes for the existence of correlated quark-antiquark pairs (pseudoscalar mesons). Although the integrals and probability amplitudes can in principle be calculated from lattice QCD or from another specific model, in this paper we treat these quantities as adjustable parameters. Although in our model neither diquarks nor mesons by themselves improve the agreement with experiment, the combined changes lead to significantly better results.

1756 Electromagnetic polarizabilities of pseudoscalar Goldstone bosons. Bernard, V. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139 (US)); Vautherin, D. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1615-1627 (1 Sep 1989).

We calculate the electromagnetic polarizabilities of the charged and neutral pions and kaons within the framework of a generalized SU(3) Nambu–Jona-Lasinio model. We obtain strong constraints on the results from chiral symmetry. The possible effects of nonlinearities in the strange-current-quark mass are studied. The values obtained for the charged-pion electromagnetic polarizabilities are within the error bars of the experimental ones. We predict charged-kaon electromagnetic polarizabilities of the order of 10^{-4} fm^3, whereas the ones of the neutral pion and kaon are an order of magnitude smaller.

1757 Higgs-boson decay into two gluinos. Ng, K. (Department of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee 37235 (US)); Pois, H.; Yuan, T. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1689-1692 (1 Sep 1989).

We present the one-loop calculations of Higgs bosons decaying into gluino pairs in minimal N=1 supergravity models and compare these rates to the one-loop decay modes with two gluons in the final state. Depending on the unknown low-energy supersymmetry parameters and the mass spectrum, rates for Higgs-boson decay into gluino pairs normalized to the $b\bar{b}$ mode typically vary from 10^{-5} to 10^{-3}.

1758 Detecting hyperphotons in kaon decays. Trampetic, J. (Brookhaven National Laboratory, Upton, New York 11973 (US)); Aronson, S.H.; Cheng, H.; Fischbach, E.; Talmadge, C. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1716-1719 (1 Sep 1989).

It is shown that the decay mode $K_L \to \pi^+\pi^-$+missing neutrals may provide an almost model-independent limit on the parameters of the quantum γ_Y of the putative fifth force. This would reduce theoretical ambiguities which arise in previous analyses of data from $K^\pm \to \pi^\pm$+missing neutrals.

1759 **Renormalization-group-improved unitarity bounds on the Higgs-boson and top-quark masses.** Marciano, W. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973 (US)); Valencia, G.; Willenbrock, S. *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1725-1729 (1 Sep 1989). DOE Contract AC02-76CH00016.

A renormalization-group-improved perturbative unitarity bound for elastic scattering amplitudes is proposed. This prescription leads to upper bounds on the Higgs boson and top-quark masses as a function of the energy at which perturbative unitarity is violated and new physics enters. Upper bounds on the scale of new physics in models with no Higgs boson are also discussed.

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 1752, 1753, 1754, 1756, 1772

1760 **Higgs decay into Goldstone Bosons.** Chivukula, R.S. (Department of Physics, Boston University, Boston, Massachusetts 02215 (US)); Cohen, A.; Georgi, H.; Grinstein, B.; Manohar, A.V. *Annals of Physics (New York) (USA),* 192(1): 93-103 (15 May 1989). DOE Contract AC02-76ER03069;AC02-86ER40284.

We comment on the calculation by Voloshin and Zakharov of the rate of decay of a light Higgs Boson into pions. © 1989 Academic Press, Inc.

1761 **Special points in three-generation moduli space.** Greene, B.R. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(5): 1645-1652 (1 Sep 1989).

We focus on some special points in the moduli space of the three-generation compactification which give rise to a four-dimensional effective Lagrangian at the compactification scale differing markedly from that found in previous studies. In particular, we consider manifolds possessing *R* symmetries as well as manifolds arising from blowing up an alternative construction of the three-generation class. In addition to the natural matter parities found in previous models, some of these constructions offer the substantial improvements of having fewer or no mirror quarks and exact flat directions (modulo an incomplete understanding of certain singlet modes) leading to three-generation models with SO(10), SU(5), or the standard-model gauge group at the compactification scale.

6454 Field Theory

Refer also to citation(s) 1727, 1731, 1750, 1751, 1752, 1755, 1756, 1761

1762 (ANL-HEP-CP–89-55) **Hamiltonian flows, Su(∞), SO(∞), USp(∞), and strings.** Zachos, C. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-891044–1: 1. international conference on radioactive nuclear beams, Berkeley, CA (USA), 16-18 Oct 1989). Order Number DE90001987. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Based on the infinite-dimensional algebras we have introduced, SU(∞) is identified with general Hamiltonian flows in 2-d phase-space, SO(∞) with flows generated by x-p-odd Hamiltonians, and USp(∞) with those of Hamiltonians of special symmetry. Gauge theories for SU(∞), SO(∞), and USp(∞) are thus formulated in terms of surface (sheet) coordinates for toroidal phase-space. Spacetime-independent configurations of their gauge fields directly yield the quadratic Schild-Eguchi string action. 15 refs.

1763 (CONF-8907140–2) **Linking the Gauss-Bonnet-Chern theorem, essential HOPF maps and membrane solitons with exotic spin and statistics.** Tze, Chia-Hsiung. Virginia Polytechnic Inst., Blacksburg, VA (USA). Dept. of Physics. 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-80ER10713. From 18. international conference on differential geometric methods in theoretical physics: physics and geometry; Tahoe City, CA (USA); 2-8 Jul 1989. Order Number DE90001451. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

By way of the Gauss-Bonnet-Chern theorem, we present a higher dimensional extension of Polyakov's regularization of Wilson loops of point solitons. Spacetime paths of extended objects become hyper-ribbons with self-linking, twisting and writhing numbers. specifically we discuss the exotic spin and statistical phase entanglements of geometric n-membrane solitons of D-dimensional KP_1 σ-models with an added Hopf-Chern-Simons term where (n, D, K) = (0, 3, C), (2, 7, H), (6, 15, Ω). They are uniquely linked to the complex and quaternion and octonion division algebras. 22 refs.

1764 (DOE/ER/13065–589) **Nijenhuis tensor and integrable models.** Okubo, Susumu. Rochester Univ., NY (USA). Dept. of Physics and Astronomy. 18 Aug 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER13065. (CONF-8908166–1: Annual seminar of the Canadian Mathematical Society, Montreal (Canada), 1-11 Aug 1989; UR–1126). Order Number DE90001403. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Let M be a differential manifold admitting two symplectic tensors $f_{\mu\nu}$ and $F_{\mu\nu}$. If the Nijenhuis tensor constructed out of $S_\mu{}^\nu = F_{\mu\lambda}f^{\lambda\nu}$ vanishes identically, then we can construct integrable dynamical system with hierarchy relation. Also, it has been shown that the zero Nijenhuis tensor condition is associated with various Lie and Lie-super algebraic structures. 11 refs.

1765 (DOE/ER/40231–T6) **Research program in elementary particle theory: Progress report for period ending December 31, 1989.** Syracuse Univ., NY (USA). 1989. 54p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER40231. Order Number DE90000730. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Syracuse High Energy Theory group has continued to make significant contributions to many areas. Many novel aspects of Chern-Simons terms and effective Lagrangians were investigated. Various interesting aspects of quantum gravity and string theory were explored. Gauge models of elementary particles were studied in depth. The investigations of QCD at finite temperatures and multiply connected configuration spaces continued. 24 refs.

1766 (DOE/ER/40231–T7) **Research program in elementary particle theory: Outstanding junior investigator program: Progress report for period ending December 31, 1989.** Bowick, M.J. Syracuse Univ., NY (USA). Dept. of Physics. 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER40231. Order Number DE90000731. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report briefly discusses the following topics: high-temperature strings; axionic black holes and wormholes; equations of motion for massless modes as vanishing curvature; vertex algebras and string theory; and massive axions. (LSP)

1767 **High-rho$_T$ single photon and jet production at Fermilab energies.** Oh, B.Y. (Dept. of Physics, The Pennsylvania State Univ., Univ. Park, PA (US)). pp. 657 of Physics simulations at high energy. Barger, V. Gottschalk, T. Halzen, F. World Scientific Pub. Co., Teaneck, NJ (1987).

It is well established that direct photons are produced in QCD via the two subprocesses $qg \rightarrow \gamma q$ (Compton) and $qq\text{-bar} \rightarrow \gamma g$ (annihilation). The attractiveness of these processes derives from (1) the single QCD vertex and (2) the gluon participation in the lowest order αs approximation, thus providing important constraints on the gluon distributions. In this brief report the authors summarize their phenomenological expectations of the high-rho$_T$ photons in rhorho ($\sqrt{s}$ = 40 GeV) and πrho ($\sqrt{s}$ = 32 GeV) interactions, carried out in preparation for Fermilab experiment E-706. This upcoming experiment will detect charged particles and photons, including the direct photons, which motivates simulation study of the event structure at these energies.

1768 **Closed string field theory from polyhedra.** Saadi, M. (Center for Theoretical Physics, Laboratory for Nuclear Science, (US)); Zwiebach, B. *Annals of Physics (New York) (USA),* 192(1): 213-227 (15 May 1989).

A fully nonpolynomial framework for closed string field theory is studied. All interactions are geometrical, the pattern of string overlaps gives polyhedra with equal perimeter faces and three edges at each vertex. All interactions are cubic in the sense that at most three strings can coincide at a point. The three point vertex used is that of Witten which is seen to be quite natural in the framework of

quadratic differentials and to induce a very symmetric decomposition of moduli space. © 1989 Academic Press, Inc.

1769 The topology of moduli space and quantum field theory. Montano, D. (Stanford Linear Accelerator Center, CA (USA)); Sonnenschein, J. *Nuclear Physics [Section] B (Netherlands)*, 324(2): 348-370 (25 Sep 1989).

We show how an SO(2,1) gauge theory with a fermionic symmetry may be used to describe the topology of the moduli space of curves. The observables of the theory correspond to the generators of the cohomology of moduli space. This is an extension of the topological quantum field theory introduced by Witten to investigate the cohomology of Yang-Mills instanton moduli space. We explore the basic structure of topological quantum field theories, examine a toy U(1) model, and then realize a full theory of moduli space topology. We also discuss why a pure gravity theory, as attempted in previous work, could not succeed. (orig.).

1770 Comment on "Canonical quantum field theory with exotic statistics". Hagen, C.R. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627 (US)). *Physical Review Letters (USA)*, 63(9): 1025-1025 (28 Aug 1989).

A Comment on the Letter by G. W. Semenoff, Phys. Rev. Lett. 61, 517 (1988).

1771 QCD minijet cross sections. Sarcevic, I. (Theoretical Division, T-8, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Ellis, S.D.; Carruthers, P. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1446-1452 (1 Sep 1989). DOE Contract AS06-88ER40423.

We calculate the lowest-order QCD jet cross section for a variety of different sets of structure functions, QCD scales, and parton minimum transverse momentum p_T^{min}. We compare our theoretical results with the experimental data for the jet differential and total cross sections including the minijet regime in order to study the correlations between the various parameters. We find that for a constant K factor the choice of scale $Q^2=p_T^2$ provides the best representation of the experimental data. With a K factor of order 2, a theoretical cutoff of $p_T^{min}\sim 3$ GeV seems to describe the observed total minijet cross section with E_T^{jet} $(E_T^{raw})\geq 5$ GeV. We extrapolate our results to yield predictions for the expected minijet cross section at the Fermilab Tevatron Collider which should have some resolving power to distinguish the different sets of structure functions and choices of scale.

1772 24×12^3 vs 16×8^3 lattices: Controlling finite-size effects in lattice SU(2) including fermions. Born, K.D. (Institut fur Theoretische Physik, Rheinisch-Westfalische Technische Hochschule Aachen, D-5100 Aachen, Federal Republic of Germany (DE)); Laermann, E.; Langhammer, F.; Walsh, T.F.; Zerwas, P.M. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1664-1666 (1 Sep 1989).

We report on the hadron spectrum, chiral-symmetry parameters, and the interquark potential of two-color SU(2) including dynamical Kogut-Susskind fermions. By comparing the results on a 24×12^3 with those on a 16×8^3 lattice, we demonstrate that finite-size effects are small in a range of couplings where approximate scaling is observed.

1773 Direct-photon searches as tests for unconventional high-energy electroweak interactions. Rosner, J.L. (Institute for Advanced Study, Princeton, New Jersey 08540 (US)); Stodolsky, L. *Physical Review [Section] D: Particles and Fields (USA)*, 40(5): 1676-1678 (1 Sep 1989).

The ability of direct-photon searches at the Fermilab Tevatron to probe thresholds for the onset of new physics is explored. It is shown that present experiments are sensitive to thresholds at the parton level of greater than 600 GeV. Moreover, the expected yields of γ+jet and Z+jet are remarkably similar, so that if difficulty is experienced in isolating a signal for direct photons, the detection of direct Z's may serve as a cross-check.

65 PHYSICS II

6510 Nuclear Physics

Refer also to citation(s) 1125, 1832, 1922

1774 (BNL-NCS-43194) **Medium energy charged particle data for evaluation.** Pearlstein, S. Brookhaven National Lab., Upton, NY (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891103-29: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90000108. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Medium energy charged particles incident on targets can cause a variety of nuclear reactions. Charged particle transport calculations require access to a large body of cross-section data which results in interest in an evaluated charge particle data library. Developing an evaluated data library can involve several steps. An index to the literature on measurements and theory is useful to locate information relevant to data evaluation. A computerized compilation of measurements facilitates the intercomparison of different experiments and the determination of how well data are known. Nuclear models, based on theory or phenonological evidence, are compared with experiment and where validated, are used to fill in regions where experimental data are not available. Finally, the selected data is placed into computer readable formats for use in transport calculations. 16 refs.

1775 (GSI-89-63(prepr.)) **Physics at SIS/ESR.** Henning, W. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Aug 1989. 11p. (CONF-890388-: 4. European Physical Society (EPS) seminar on international research facilities, Zagreb (Yugoslavia), 17-19 Mar 1989). Available from Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The proposed research program at SIS/ESR extends over many different aspects of nuclear, nuclear-matter and atomic physics. In addition, various experiments are in preparation for biological and applied research. This enormous effort is only possible through the collaborative effort of scientists from many institutions and universities, coming from many different countries. The present overview can only be seen as a coarse survey in the areas of nuclear, nuclear-matter and atomic physics, with some of the collaborations listed under the references. (orig.).

1776 (LA-UR-89-2210) **Transport data libraries for incident proton and neutron energies to 100 MeV.** Young, P.G.; Arthur, E.D.; Bozoian, M.; England, T.R.; Hale, G.M.; LaBauve, R.J.; Little, R.C.; MacFarlane, R.E.; Madland, D.G.; Perry, R.T. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891103-4: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014469. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A joint effort between the Applied Nuclear Science and Radiation Transport groups at Los Alamos has begun to develop and implement proton, neutron, and photon transport libraries for incident energies up to 100 MeV. The major steps involved in this effort are: (1) development of evaluated (ENDF/B) data formats appropriate for higher energies; (2) extension of low-energy nuclear physics theoretical models for applicability up to 100 MeV; (3) calculation and evaluation of nuclear data in ENDF/B-VI format for appropriate materials up to 100 MeV; (4) development of processing code capabilities to handle the higher energy data; and (5) development of the appropriate interfaces and code patches for use of data in transport codes such as MCNP. In this paper we mainly discuss the development of the basic transport data library, items (2) and (3) above, and summarize the remaining activities. 14 refs.

1777 (ZfK-584) **Annual report 1985 on nuclear physics activities and applications.** Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986.

180p. Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Individual items are processed separately for the data base. (DLC)

1778 (ZfK–584, pp. 110) **Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Merla, K.; Musiol, G.; Pausch, G.; Drapchinsky, L.V. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. ALUMINIUM 27 TARGET/alpha spectra; ALUMINIUM 27 TARGET/corrections; OXYGEN 16 TARGET/alpha spectra; OXYGEN 16 TARGET/corrections; TITANIUM 48 TARGET/alpha spectra; TITANIUM 48 TARGET/corrections; TRITIUM TARGET/chemical composition; ALPHA PARTICLES; CORRECTIONS; BACKGROUND RADIATION; CORRELATIONS; CROSS SECTIONS; DEUTERON REACTIONS; FISSION NEUTRONS; FOILS; IMPURITIES; LAYERS; NUCLEAR REACTION ANALYSIS; SPECTRA UNFOLDING

6511 Experimental Techniques

1779 (CONF-890875–2) **A proposed method of measuring the electric-dipole moment of the neutron by ultracold neutron interferometry.** Freedman, M.S.; Peshkin, M.; Ringo, G.R.; Dombeck, T.W. Argonne National Lab., IL (USA). Aug 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. international symposium on foundations of quantum mechanics; Tokyo (Japan); 27-31 Aug 1989. Order Number DE90002180. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The use of an ultracold neutron interferometer incorporating an electrostatic accelerator having a strong electric field gradient to accelerate neutrons by their possible electric dipole moment is proposed as a method of measuring the neutron electric dipole moment. The method appears to have the possibility of extending the sensitivity of the measurement by several orders of magnitude, perhaps to 10^{-30} e-cm. 9 refs., 3 figs.

1780 (CONF-8910237–2) **Heavy ions as probes of nuclei far from stability.** Moltz, D.M.; Nitschke, J.M.; Wilmarth, P.A.; Toth, K.S. Oak Ridge National Lab., TN (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International school seminar on heavy ion physics; Dubna (USSR); 3-12 Oct 1989. Order Number DE90001608. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nuclei located far from stability provide us with an opportunity for studying nuclear matter existing under unusual conditions. In these regions of instability, radioactive decay becomes the predominant technique by which one can obtain structure information. We have been involved in the investigation of nuclear properties of nuclei close to the proton drip line. In our explorations we have utilized heavy-ion fusion, followed by particle evaporation, to produce the extremely neutron-deficient nuclei of interest. In our studies, single-particle states near the 82-neutron shell, populated in the β decay of short-lived nuclides, have been examined and their excitation energies determined. Numerous new isotopes, isomers, and β-delayed-proton and α-particle emitters have been discovered. This contribution will discuss our particle-decay investigations. These decay modes provide us with a convenient means of discovering new isotopes whose identification opens the way for further, more extensive explorations. Also, particle-decay energies in many instances can be used to determine mass differences between parent and daughter ground states. Such measurements are therefore used to test mass formulae and to obtain estimates of masses for proton rich nuclei. 19 refs., 13 figs.

6512 Nuclear Properties and Reactions, A=1-5, Experimental

1781 (Juel–2294) **KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events.** Wenzl, H.; Treusch, J. (eds.). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Jul 1989. 123p. Order Number DE90718150. Available from NTIS (US Sales Only), PC A06/MF A01.

Deuterium has been incorporated into palladium crystals by electrochemical methods to analyze possible cold fusion events. Various palladium samples with masses between 1 and 100 g and different surface area have been used. They were loaded with D up to a concentration of $PdD_{0.7}$. During electrolysis the rate of heat flow, deuterium and oxygen gas flow and neutron production was measured. After electrolysis the helium content of the samples and the tritium content of the electrolyte were analyzed. Deuterium has also been incorporated into titanium from the gas phase to generate TiD_2. In cooling and heating runs the rate of release of fast neutrons was measured to detect possible fusion events. (orig./RB).

1782 (ZfK–584, pp. 112) **Cone broadening in time-correlated associated-particle method fission cross-section measurements.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Musiol, G.; Pausch, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION NEUTRONS/angular distribution; FISSION NEUTRONS/nuclear reaction kinetics; PROTONS/angular distribution; PROTONS/nuclear reaction kinetics; CONES; CORRELATIONS; CROSS SECTIONS; DEUTERON REACTIONS; ERRORS; HELIUM 3 TARGET; HELIUM 4; LINE BROADENING; PROTONS; SCATTERING; SPECIFICATIONS; TRITIUM TARGET

1783 **Reaction ^{3}He(π^+,pp)p at T_π=350 and 500 MeV.** Smith, L.C. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901 (US)); Minehart, R.C.; Ashery, D.; Piasetsky, E.; Moinester, M.; Navon, I.; Geesaman, D.F.; Schiffer, J.P.; Stephens, G.; Zeidman, B.; and others. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1347-1362 (Sep 1989). DOE Contract FG05-88ER40390.

The reaction ^{3}He(π^+,pp)p was measured at T_π=350 and 500 MeV in a kinematically complete experiment. Separate contributions from two-body and three-body pion absorption are clearly seen in recoil momentum distributions. The two-body angular distributions closely follow the shape of the free $\pi d \rightarrow pp$ cross section, although the number of deuterons estimated from the two-body yield is larger than the value 1.5 expected from isospin coupling and observed previously at lower energies. Comparison with a simple impulse approximation model suggests some of the enhancement may arise from binding of the quasideuteron, although absorption on T=1 (pn) pairs and the higher density of ^{3}He may also be a factor. The strength of the three-body component falls off with bombarding energy with roughly the same slope as for the two-body component, and accounts for ≈45% of the total absorption cross section, a larger fraction than reported previously below the (3,3) resonance. The three-body matrix element $|M_3|^2$ displays an angular dependence at both energies which is suggestive of initial-state interactions. No evidence of final-state interactions is seen.

1784 **Radiative capture of tensor and vector polarized deuterons by ^{3}H at 400 keV.** Riley, J.C. (Duke University, Durham, North Carolina 27706 (US)); Weller, H.R.; Tilley, D.R. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1517-1519 (Sep 1989).

The ^{3}H($\vec{d}$,γ)^{5}He reaction observables $\sigma(\theta)$, $A_y(\theta)$, and $A_{yy}(\theta)$ have been measured at seven angles with a 400 keV incident deuteron beam which was stopped in a tritiated titanium target. The data have been fit using a transition matrix element analysis. This analysis indicates that the cross section is primarily channel spin

S=3/2 *E*1 radiation, with approximately 2.5% *S*=1/2 *E*1 radiation and 2.5% *M*1 radiation.

6513 Nuclear Properties and Reactions, A=6-19, Experimental

Refer also to citation(s) 1788

1785 (CENBG–88-23) **Angular momentum distributions of autoionizing states produced in 1.5 MeV C^{q+} + C_{foil} and C^{q+} + He collisions.** Stolterfoht, N.; Andriamonje, S.; Scheurer, J.N.; Bertault, D.; Chemin, J.F.; Yamazaki, Y.; Miller, P.D.; Krause, H.F.; Pepmiller, P.L. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1988. 2p. (CONF-880955–: International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources, Grenoble (France), 12-16 Sep 1988). Order Number DE90713788. Available from NTIS (US Sales Only), PC A02/MF A01.

Using the method of zero-degree Auger spectroscopy, we have measured electrons emitted in the decay of autoionizing Rydberg states. Electron energies from Coster-Kronig transitions in C^{2+} were measured for 1.5 - 3 MeV C^{q+} + C_{foil} collisions as well as for C^{2+} + He and C^{3+} + He collisions. The ion-gas and ion-foil collisions experiments have been performed under the same experimental conditions in order to observe directly the difference between the l-distributions produced by gas and solid target.

1786 (CRN-PN–89-03) **Selectivity in heavy ion transfer reactions.** Boucenna, A. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1989. 158p. (In French). Order Number DE90713776. Available from NTIS (US Sales Only), PC A08/MF A01.

One-two-and three-nucleon stripping reactions induced by 480 MeV ^{12}C and by 793 MeV ^{16}O have been studied on ^{12}C, ^{16}O, ^{28}Si, ^{40}Ca, and ^{54}Fe targets. Discrete levels are fed with cross sections up to 1 mb/sr for d-transfer reactions and one and two orders of magnitude less for 2p- and ^{3}He-transfers, respectively. These reactions are governed by two selection rules contained in the semi-classical model of Brink: (i) Large orbital final momentum states are selectively populated and (ii) The most highly populated states correspond to no-flip transitions. Two-proton transfer reactions induced by 112 MeV ^{12}C on even Ni and Zn isotopes are found to be less selective than two-neutron transfer reactions induced by the same projectile on the same targets in a similar incident energy range. The additional collective aspects observed in the two-proton transfers are examined in view of a semiphenomenological model of two quasi-particles coupled to a triaxial asymmetric rotor. The energy of excited states is well reproduced by simple shell model calculations. Such estimates are useful in proposing spins of newly observed states, especially as the shapes of the measured angular distributions are independant of the final spin of the residual nucleus. The experimental results of two-proton and two-neutron stripping reactions and the simple shell model allow an estimate of two-body matrix elements describing the nucleon-nucleon interaction and of the Coulomb energy.

1787 **Mass and transverse momentum dependence of the dielectron yield in *p*-Be collisions at 4.9 GeV.** Letessier-Selvon, A. (The DLS Collaboration (Lawrence Berkeley Laboratory, Berkeley, CA 04720 (US)); Bystricky, J.; Carroll, J.; Gordon, J.; Hallman, T.; Igo, G.; Kirk, P.; Krebs, G.F.; Lallier, E.; Landaud, G.; and others. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(3): 1513-1516 (Sep 1989).

We present the invariant mass and transverse momentum dependence of direct electron-positron pair production in *p*-Be collisions at a beam kinetic energy of 4.9 GeV. The acceptance of our apparatus is shown to have no significant effect for masses above 0.15 GeV. After a correction is made for the available phase space, the transverse momentum dependence of the data is found to be comparable to hadron-hadron observations. A phenomenological calculation involving $\pi^+\pi^-$ annihilation into e^+e^- is shown to be in good agreement with our measurements.

6514 Nuclear Properties and Reactions, A=20-38, Experimental

Refer also to citation(s) 1786

1788 (LBL–27691) **Equilibrium and non-equilibrium emission of complex fragments.** Bowman, D.R. Lawrence Berkeley Lab., CA (USA). Aug 1989. 189p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90002685. Available from NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

Complex fragment emission ($Z>2$) has been studied in the reactions of 50, 80, and 100 MeV/u ^{139}La + ^{12}C, and 80 MeV/u ^{139}La + ^{27}Al, ^{nat}Cu, and ^{197}Au. Charge, angle, and energy distributions were measured inclusively and in coincidence with other complex fragments, and were used to extract the source rapidities, velocity distributions, and cross sections. The experimental emission velocity distributions, charge loss distributions, and cross sections have been compared with calculations based on statistical compound nucleus decay. The binary signature of the coincidence events and the sharpness of the velocity distributions illustrate the primarily 2-body nature of the ^{139}La + ^{12}C reaction mechanism between 50 and 100 MeV/u. The emission velocities, angular distributions, and absolute cross sections of fragments of $20\leq Z\leq 35$ at 50 MeV/u, $19\leq Z\leq 28$ at 80 MeV/u, and $17\leq Z\leq 21$ at 100 MeV/u indicate that these fragments arise solely from the binary decay of compound nuclei formed in incomplete fusion reactions in which the ^{139}La projectile picks up about one-half of the ^{12}C target. In the 80 MeV/u ^{139}La + ^{27}Al, ^{nat}Cu, and ^{197}Au reactions, the disappearance of the binary signature in the total charge and velocity distributions suggests and increase in the complex fragment and light charged particle multiplicity with increasing target mass. As in the 80 and 100 MeV/u ^{139}La + ^{12}C reactions, the lighter complex fragments exhibit anisotropic angular distributions and cross sections that are too large to be explained exclusively by statistical emission. 143 refs., 67 figs.

6515 Nuclear Properties and Reactions, A=39-58, Experimental

Refer also to citation(s) 1203, 1786

6516 Nuclear Properties and Reactions, A=59-89, Experimental

Refer also to citation(s) 1788

1789 (BNL–43057) **Nuclear structure in the neutron-rich doubly magic ^{78}Ni region.** Hill, J.C.; Wohn, F.K.; Winger, J.A.; Warburton, E.K.; Gill, R.L.; Schuhmann, R.B. Brookhaven National Lab., Upton, NY (USA). [1989]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016;W-7405-ENG-82. (CONF-8909247–2: ACS symposium on exotic nuclear spectroscopy, Miami Beach, FL (USA), 11-15 Sep 1989). Order Number DE90002588. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The magic numbers Z=28 and N=50 imply that very neutron-rich ^{78}Ni, which has not yet been observed, is doubly magic. The ^{78}Ni region was investigated by studying the N=50 isotones and neutron-rich Zn isotopes. Results on the level structure of ^{83}As, ^{74}Zn, and ^{76}Zn populated in the decays of ^{83}Ge, ^{74}Cu, and ^{76}Cu are presented. The parent nuclides were produced and mass separated using the TRISTAN facility on-line to the High-Flux Beam Reactor at Brookhaven. The systematics of the N=50 isotones and even-A Zn isotopes are discussed and compared with shell-model calculations involving active nucleons outside of a ^{78}Ni and ^{66}Ni core, respectively. The extent to which the ^{78}Ni region can be considered doubly magic is assessed. 43 refs., 7 figs.

1790 **^{89}Y+n resonances for E=10-740 keV and intermediate structure.** Agrawal, H.M. (State Univ. of New York, Albany (USA)); Garg, J.B.; Harvey, J.A. *Nuclear Physics [Section] A (Netherlands)*, 501(1): 18-50 (11 Sep 1989).

High-resolution neutron total-cross-section measurements on ^{89}Y have been made from a few eV to MeV using the pulsed neutron time-of-flight spectroscopy at ORELA with a neutron burst width of 5

ns and a nominal resolution of 0.025 ns/m at the highest energy. We have analyzed the data from 10-740 keV using a multilevel R-matrix code and obtained the values of resonance parameters (E_0,J^π, $g\Gamma_n$). From these results we have obtained the values of average quantities up to about 600 keV: $D_{1,=0}$=4.6+-0.3 keV, $D_{1,=1}$=1.35+-0.15 keV; S_0=0.33+-0.045, S_1=5.82+-0.38, in units of 10^{-4} $eV^{-1/2}$. The staircase plots of reduced neutron widths for s- and p-waves and the plots of the Lorentz-weighted strength functions averaged over different energy intervals show an evidence of several doorway states. A least-squares fit to the lorentzian smooth curves provides the best values of E_d (doorway energy) and γ^2_{dc} (escape reduced width of doorway). These values are in qualitative agreement with the theoretical predictions. The experimental ratio of s- to p-wave level spacings was found to be 3.43+-0.6. This is in disagreement with the theoretical prediction of 2.06 (for σ=3.8) and indicates a parity dependence of the level density at high excitation. (orig.).

6517 Nuclear Properties and Reactions, A=90-149, Experimental

Refer also to citation(s) 1918

1791 (UCRL–101174) **Biomodal spontaneous fission.** Hulet, E.K. Lawrence Livermore National Lab., CA (USA). 26 Sep 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910227–1: 50. anniversary of nuclear fission, Leningrad (USSR), 16-20 Oct 1989). Order Number DE90001516. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Investigations of mass and kinetic-energy distributions from spontaneous fission have been extended in recent years to an isotope of element 104 and, for half-lives, to an isotope of element 108. The results have been surprising in that spontaneous fission half-lives have turned out to be much longer than expected and mass and kinetic- energy distributions were found to abruptly shift away from those of the lighter actinides, showing two modes of fission. These new developments have caused a re-evaluation of our understanding of the fission process, bringing an even deeper appreciation of the role played by nuclear shell effects upon spontaneous fission properties. 16 refs., 10 figs.

1792 **Giant *M*1 resonance in ^{120}Sn and the quenching of the nucleon spin *g* factors.** Alarcon, R. (Nuclear Physics Laboratory and Department of Physics, University of Illinois at Urbana-Champaign, Champaign, Illinois 61820 (US)); Laszewski, R.M.; Dale, D.S. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1097-1099 (Sep 1989).

The distribution of magnetic dipole transition strength in ^{120}Sn has been measured at excitations between 7.3 and 9.3 MeV using highly polarized tagged photons. A total *M*1 strength of Σ eV corresponding to $B(M1\uparrow)=8.8_{-0.9}{}^{+1.1}\,\mu_0{}^2$ *was found to be more or less uniformly distributed throughout the region. This result and previous polarized photon measurements in* ^{90}Zr and the Pb nuclei present a consistent picture of *M*1 strengths in closed-shell nuclei in terms of the required normalization for the spin nucleon *g* factors. Normalizations with respect to the bare nucleon values are 0.68±0.02 and 0.64±0.03 for the proton and neutron spin *g* factors, respectively.

6518 Nuclear Properties and Reactions, A=150-189, Experimental

Refer also to citation(s) 1918

1793 **Neutron emission cross sections on ^{184}W at 11.5 and 26 MeV and the neutron-nucleus scattering mechanism.** Marcinkowski, A. (Ohio Univ., Athens (USA)); Finlay R.W.; Rapaport, J.; Hodgson P.E.; Chadwick, M.B. *Nuclear Physics [Section] A (Netherlands),* 501(1): 1-17 (11 Sep 1989).

Inelastic neutron emission at 11.5 and 26 MeV incident energies has been studied for monoisotopic sample of ^{184}W. Time-of-flight spectra were taken at several angles between 12^0 and 160^0 using a beam-swinger spectrometer. The data are averaged over 1 MeV energy bins and compared with the quantum-mechanical statistical multistep calculations (orig.).

6519 Nuclear Properties and Reactions, A=190-219, Experimental

Refer also to citation(s) 1788

1794 (DOE/ER/40402–2) **Oregon State University nuclear chemistry progress report, August 1, 1988–August 1, 1989.** Loveland, W.D. Oregon State Univ., Corvallis, OR (USA). Aug 1989. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40402. Order Number DE90001177. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The work described herein is part of a project involving the study of intermediate energy, and relativistic heavy ion reactions. The intermediate energy research focused on the characterization of the heavy residues, the large target fragments with $A_{frag}>2/3\ A_{target}$. For the reaction of 85 MeV/nucleon ^{12}C with ^{197}Au, we had measured the heavy residue yields and angular distributions previously. We report herein the measurement of their energy spectra. The average residue energies are quite low, ranging from 15 keV/nucleon to 314 keV/nucleon. These low energies imply errors in some previous measurements of heavy residues in that many residues have energies below counter thresholds, etc. The essential physics of heavy residue production is shown to be correctly described by a VUU calculation. For the reaction of 35 and 43 MeV/nucleon Kr with Au, we found the linear momenta of the near-target heavy residues to be in agreement with models of peripheral collisions. For the heavy residues with large ΔA values, the residue linear momenta approach a limiting value which is far below that expected from the "universal" systematics of linear momentum transfer in reactions induced by smaller projectiles. Reasons for this limiting behavior are suggested. In the area of relativistic nuclear collisions, complete target fragment mass distributions were measured for the ultrarelativistic reactions of 13.6 GeV/nucleon ^{16}O and ^{28}Si with ^{197}Au. An unexpected finding in this study was the relatively large cross section for the two neutron removal process via electromagnetic dissociation. Similar measurements for the reaction of 1.1 GeV/nucleon ^{197}Au with ^{197}Au furnished the first complete fragment mass distribution for that reaction.

1795 **Comment on "Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei".** Raman, S. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (US)). *Physical Review Letters (USA),* 63(10): 1116-1116 (4 Sep 1989). DOE Contract AC05-84OR21400.

A Comment on the Letter by Moshe Gai, Phys. Rev. Lett. 61, 2424 (1988).

1796 **Gai replies.** Gai, M. (A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511 (US)). *Physical Review Letters (USA),* 63(10): 1117-1117 (4 Sep 1989).

Gai clarifies the contents in the comment given by Raman. Gai then discusses the definition of nuclear collectivity and the isoscalar energy-weighted sum rule.

6520 Nuclear Properties and Reactions, A=220 and Above, Experimental

Refer also to citation(s) 1795, 1796

1797 (CONF-891103–19) **ENDF/VI six-group delayed neutron data.** England, T.R.; Brady, M.C. Los Alamos National Lab., NM (USA); Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36;AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89015871. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In addition to individual precursor data [emission probabilities (Pn) and neutron spectra], the ENDF system requires $\bar{\nu}$(E), and its time-dependence and spectra using a few time groups. These data have been greatly extended, tested, and recently (June 1989) compared with new measurements of pulse spectra. 7 refs., 2 figs.

1798 (LA-UR–89-2207) **ENDF/B-VI six-group delayed neutron data.** England, T.R.; Brady, M.C. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research.

DOE Contract W-7405-ENG-36. (CONF-891103–6: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014271. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper evaluates ENDF/B-VI delayed neutron data for ^{235}U, ^{238}U, and ^{239}Pu. (LSP)

6530 Nuclear Theory

Refer also to citation(s) 867, 1735, 1736

1799 (CONF-890902–19) **Reflection asymmetric shapes in nuclei.** Ahmad, I.; Carpenter, M.P.; Emling, H.; Holzmann, R.; Janssens, R.V.F.; Khoo, T.L.; Moore, E.F.; Morss, L.R.; Durell, J.L.; Fitzgerald, J.B.; Mowbary, A.S.; Hotchkiss, M.A.; Phillips, W.R.; Drigert, M.W.; Ye, D.; Benet, P. Argonne National Lab., IL (USA). 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep 1989. Order Number DE90001984. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Experimental data show that there is no even-even nucleus with a reflection asymmetric shape in its ground state. Maximum octupole-octupole correlations occur in nuclei in the mass 224 (N~134, Z~88) region. Parity doublets, which are the characteristic signature of octupole deformation, have been observed in several odd mass Ra, Ac and Pa nuclei. Intertwined negative and positive parity levels have been observed in several even-even Ra and Th nuclei above spin ~8$\hbar$. In both cases, the opposite parity states are connected by fast El transitions. In some medium-mass nuclei intertwined negative and positive parity levels have also been observed above spin ~7$\hbar$. The nuclei which exhibit octupole deformation in this mass region are ^{144}Ba, ^{146}Ba and $_{146}Ce$; ^{142}Ba, ^{148}Ce, ^{150}Ce and ^{142}Xe do not show these characteristics. No case of parity doublet has been observed in the mass 144 region. 32 refs., 16 figs., 1 tab.

1800 (GSI–89-64(prepr.)) **Absence of parity effects in preequilibrium γ emission.** Oblozinsky, P. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Aug 1989. 7p. Available from Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

We argue that the emission rate of dipole γ rays in the preequilibrium hybrid model is not affected by the parity constraint which the dipole operator imposes on single-particle radiative transitions. Consequently, parity can be neglected when calculating preequilibrium spectra of medium-energy γ rays. The emission rate by Reffo et al. should be scaled down by a factor of 4. (orig.).

1801 (GSI–89-68(prepr.)) **Possibility of transient effects during the emission of intermediate mass fragments.** Pochodzalla, J.; Charity, R.J.; Lynen, U.; Sann, H.; Trautmann, W.; Trockel, W. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Sep 1989. 13p. Order Number DE90718232. Available from NTIS (US Sales Only), PC A03/MF A01.

Multiplicity distributions of intermediate mass fragments observed in the reactions $^{18}O+^{nat}Ag$ and $^{18}O+^{197}Au$ at E/A=84 MeV are compared to statistical model calculations. The emission of intermediate mass fragment from a highly excited ($E_x/A \geq 6$ MeV) A=100 nucleus is found to be suppressed compared to the predictions of a sequential statistical evaporation model. This deficiency may be interpreted as resulting from dynamical constraints imposed by the finite time necessary to emit complex fragments. (orig.).

1802 (INIS-BR–1624, pp. 58) **Semiempirical model for calculating the critical frequency of F region on Concepcion, Chile.** Arriagada, M.A. (Universidad del Biobio, Concepcion (Chile)); Foppiano, A.J.; Saavedra, N. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (In Spanish). (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. CRITICAL FREQUENCY/ mathematical models; F REGION/critical frequency; CHILE

1803 (JINR-E–4-89-55) **On the influence of the quadrupole pairing on the energies of the two-quasiparticle states in deformed nuclei.** Karadjov, D.; Soloviev, V.G.; Sushkov, A.V. Joint Inst. for Nuclear Research, Dubna (USSR). 27 Jan 1989. 7p. Order Number DE90000161. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI.

The effect of the quadrupole pairing on the energies of the two-quasiparticles states in even-even deformed nuclei is investigated. From the comparison of the calculated with experimental two-quasiparticle energies one concludes that the quadrupole pairing constant G_τ^{20} should be less than one half of the quadrupole isoscalar particle-hole constant κ_0^{20}. A more exact value for G_τ^{20} can be found by investigating the 0^+ - states. One concludes that the calculation in the frame of the quasiparticle-phonon model of the characteristics of $K^\pi \neq 0^+$ states in deformed nuclei can be performed disregarding the quadrupole pairing. 9 refs., 2 tabs.

1804 (JINR-E–6-89-413) **Second class currents in the μ^--capture by polarized light nuclei.** Kathat, C.L. Joint Inst. for Nuclear Research, Dubna (USSR). 22 Jun 1989. 19p. (CONF-8904280–1: International conference on electromagnetic transitions in atomic nuclei, Tashkent (USSR), 18-21 Apr 1989). Order Number DE90000718. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The influence of second class currents (SCC) and the muon neutrino mass ($m_{\nu\mu}$) on the coefficient of the angular asymmetry ($\alpha_{\mu\nu}$) of the neutrino emission with respect to the muon spin, on the coefficient of the correlation between the directions of the polarizations of the muon and nucleus ($A_{\mu n}$) and on the coefficients of the transverse (A_N) and side-way (A_S) asymmetries are investigated. The geometrical configurations of tests which are in optimum for experiments on the observation of the SCC-induced effects in the coefficients $\alpha_{\mu\nu}$, $A_{\mu n}$, A_S and A_N are extracted.

1805 (LA–11701-MS) **A new system for analyzing neutron multiplicities: Characterization and some specific applications.** Brunson, G.S.; Arnone, G.J. Los Alamos National Lab., NM (USA). Nov 1989. 33p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002327. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We use a RAM chip to perform the functions of 15 parallel shift registers. This provides separate pulse handling for up to 15 independent detector channels, which results in a significant reduction of dead time in the system as a whole. Our algorithm extracts parameters describing the statistics of individual pulse clusters (pulses from correlated neutrons). These parameters include several probability ratios and moments of various orders. The performance of the system has been examined with respect to the following factors: multiplication non-correlated background, counter sensitivity, time width of the window, and identity of the spontaneously fissioning isotopes (^{238}Pu, ^{240}Pu, ^{242}Pu, ^{244}Cm, and ^{252}Cf). The system gives the same chain characteristics for ^{252}Cf for count rates varying over three orders of magnitude, thereby demonstrating successful unfolding of overlapping chains. 5 refs., 16 figs., 10 tabs.

1806 (LA-UR–89-2209) **Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV.** Wilson, W.B.; Arthur, E.D.; Bozoian, M.; Perry, R.T.; Young, P.G. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891103–5: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89014270. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper reviews nuclear data of calculated proton-induced thick-target neutron and gamma yield spectra for energies less than 100 MeV. 15 refs., 1 fig. (LSP)

1807 (LBL–27617) **Collective flow measured with the Plastic Ball.** Ritter, H.G.; Gutbrod, H.H.; Kampert, K.H.; Kolb, B.; Poskanzer, A.M.; Schicker, R.; Schmidt, H.R.; Siemiarczuk, T. Lawrence Berkeley Lab., CA (USA). Aug 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905143–17: NATO advanced study institute international advanced course on the nuclear equation of state, Peniscola

(Spain), 12 May - 3 jun 1989). Order Number DE90000551. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The experimental results from the Plastic Ball detector have contributed vastly to the understanding of the reaction mechanism of nuclear collisions at several hundred MeV per nucleon. The discovery of the collective flow phenomena (bounce-off of spectator fragments, side-splash in the reaction plane, and squeeze-out out of the reaction plane), as they were predicted by hydrodynamical models, has led to the experimental observation of compressed nuclear matter, which is a necessary condition before one can study the equation of state in detail and search for phase transitions at higher energies. 39 refs., 9 figs., 1 tab.

1808 (NEANDC(J)–140/U) **[Japan Atomic Energy Research Institute] progress report, July 1988–June 1989.** Kikuchi, S. (ed.). Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment. c Aug 1989. 107p. Sponsored by Japan Atomic Energy Research Institute. (INDC(JPN)–127/U). Available from Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai-mura, Ibaraki-ken, Japan.

This is a collection of reports which have been submitted to the Japanese Nuclear Data Committee at the committee's request. The request was addressed to individuals who might represent or be in touch with groups doing researches related to the nuclear data of interest to the development of the nuclear energy program. This document is comprised of individual reports which have been catalogued separately.

1809 (ZfK–584, pp. 129) **PEP (promptly emitted particles) - a Fortran program for calculation of fast nucleon emission in heavy-ion reactions.** Biedermann, M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Maedler, P. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. HEAVY ION REACTIONS/precompound-nucleus emission; PRECOMPOUND-NUCLEUS EMISSION/p codes; CROSS SECTIONS; FORTRAN; IMPACT PARAMETER; MULTIPLICITY; TRAJECTORIES

1810 (ZfK–584, pp. 130) **HOT - a Fortran program for calculation of fast nucleon emission from a hot zone.** Biedermann, M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Maedler, P. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. HEAVY ION REACTIONS/precompound-nucleus emission; PRECOMPOUND-NUCLEUS EMISSION/h codes; CROSS SECTIONS; FORTRAN; IMPACT PARAMETER; LABORATORY SYSTEM; TEMPERATURE DEPENDENCE; TIME DEPENDENCE; TRAJECTORIES

1811 (ZfK–584, pp. 133) **Fortran programs KASSAMBA and STRIDEM.** Keller, H.J. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. HEAVY ION REACTIONS/k codes; HEAVY ION REACTIONS/s codes; TERNARY FISSION/k codes; TERNARY FISSION/s codes; DATA PROCESSING; ENERGY SPECTRA; FORTRAN; TWO-DIMENSIONAL CALCULATIONS

1812 (ZfK–584, pp. 134) **ISOPLOT 2 - a program for graphic representation of functions Z = F(X,Y).** Boettger, H.; Gippner, P. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION FRAGMENTS/computer graphics; FISSION FRAGMENTS/mass distribution; ANGULAR CORRELATION; ENERGY SPECTRA; FUNCTIONS; I CODES; INTERPOLATION; SPECIFICATIONS; TIME-OF-FLIGHT SPECTROMETERS

1813 **Double Gamow–Teller strength in nuclei.** Auerbach, N. (Physics Department, University of Tel Aviv, 69978 Ramat Aviv, Tel Aviv, Israel (IL)); Zamick, L.; Zheng, D.C. *Annals of Physics (New York) (USA),* 192(1): 77-84 (15 May 1989).

The Gamow–Teller transition strength from (N,Z) to $(N-2,Z+2)$ nuclei is studied using extended space shell-model calculations. The notion of a giant double Gamow–Teller state is introduced. The application of these ideas to double beta-decay and pion double charge exchange is introduced. A good signature in light-medium mass nuclei of the double Gamow–Teller mechanism in pion double charge exchange from the $J=0$ ground state of an even–even nucleus is the excitation of both $J=0^+$ and $J=2^+$ states in the final nucleus. © 1989 Academic Press, Inc.

1814 **The role of dynamic symmetries and supersymmetries in nuclear physics.** Iachello, F. (Center for Theoretical Physics, Sloane Laboratory, Yale University, New Haven, Connecticut 06511 (US)). *Annals of Physics (New York) (USA),* 192(1): 133-145 (15 May 1989).

The role played by dynamic symmetries and supersymmetries in nuclear physics is discussed. Experimental examples are shown. The implications to other fields of physics are briefly reviewed. © 1989 Academic Press, Inc.

1815 **Nucleon and nuclear anapole moments.** Haxton, W.C. (Institute for Nuclear Theory, Department of Physics, FM-15, University of Washington, Seattle, Washington 98195 (US)); Henley, E.M.; Musolf, M.J. *Physical Review Letters (USA),* 63(9): 949-952 (28 Aug 1989).

The leading T-conserving P-nonconserving (PNC) electromagnetic coupling to the nucleon or nucleus is known as the anapole moment. We evaluate the pion-cloud contribution to the nucleon anapole moment, and the enhancements in nuclei associated with meson-exchange currents and with the mixing of the nuclear ground state with opposite-parity excited states. We find that the anapole moment becomes the dominant PNC spin-dependent coupling in heavy nuclei.

1816 **Yukawa theories as effective theories of quantum chromodynamics for a large number of colors.** Kiritsis, E. (California Institute of Technology, Pasadena, California 91125 (US)); Seki, R. *Physical Review Letters (USA),* 63(9): 953-956 (28 Aug 1989).

An effective theory for low-energy nuclear interactions is proposed, based on results obtained from the $1/N_c$ expansion of quantum chromodynamics. The Lagrangian is local in the meson sector, but in the baryon sector it is nonlocal both in the meson-baryon Yukawa coupling and in the baryon propagators. It satisfies an important consequence of the $1/N_c$ expansion, the suppression of baryon loops. Our findings are then shown to support the traditional approaches in nuclear physics and, more especially, the relativistic nuclear many-body theories at baryon-tree level.

1817 **Relations between polarized-proton-nucleus and unpolarized-transverse-electron-nucleus scattering and applications.** Zheng, D.C. (Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08855 (US)); Zamick, L. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1120-1125 (Sep 1989).

We calculate the cross section for polarized-proton-nucleus non-spin-flip (↑↑) and spin-flip (↓↑) inelastic scattering where the polarization is perpendicular to the scattering plane. This cross section is compared with that of unpolarized-electron-nucleus scattering. We note that, in the plane-wave impulse approximation, the non-spin-flip squared form factor is essentially the same, apart from a factor of q^2, as one obtained in *unpolarized*-electron-nucleus scattering in which only the spin terms are kept and the convection terms dropped. But the spin-flip squared form factor is different.

1818 Separable expansion for the two-body *T* matrix based on a nonsingular scattering equation. Haberzettl, H. (Physikalisches Institut, Universitat Bonn, D-5300 Bonn, Federal Republic of Germany (DE)). *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1147-1158 (Sep 1989).

We derive a separable representation of the two-body *T* matrix, which is exact half on shell at all energies even when truncated to one single term. Moreover, the truncated expansion satisfies the full off-shell unitarity relation. The approach does not have recourse to some complete set of functions but rather uses properties of the Lippmann-Schwinger equation itself to arrive at the expansion. It is based on the *W*-matrix representation of the two-body *T* matrix introduced by Bartnik, Haberzettl, and Sandhas. That representation provides a splitting of the *T* matrix in one single separable term which contains all bound-state poles and scattering cuts and in a nonsingular, real remainder which vanishes half on shell. The method presented here yields a separable expansion of this remainder in which all its properties are preserved in each order. Increasing the order of the expansion, the amount of additional numerical work is constant at each stage. The method is ap- plicable to any kind of short-range potential, local, nonlocal, or energy dependent. Numerical tests using the semirealistic Malfliet-Tjon III potential demonstrate the smooth and rapid convergence of the expansion.

1819 Single nucleon removal in relativistic nuclear collisions. Benesh, C.J. (Physics Department, Iowa State University, Ames, Iowa 50011 (US)); Cook, B.C.; Vary, J.P. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1198-1206 (Sep 1989).

We implement a simple approach to the inclusive cross section for single nucleon removal by relativistic nucleons and nuclei. We first develop the projectile and target dependence of the mean number, $N(b)$, of nucleon-nucleon collisions as a function of impact parameter in the peripheral region. Using the Glauber approximation, we obtain a simple parametrization for a critical impact parameter b_c such that the reaction cross sections for both *N-B* and *A-B* collisions are well represented by πb_c^2. Further study of the b dependence of $N(b)$ around $b=b_c$ allows us to develop a parametrization of single nucleon abrasion cross sections. Next, we employ the Weizsacker-Williams approximation with b_c as the cutoff impact parameter to calculate the Coulomb contribution to the single nucleon removal process. The results are compared with recent data which suggest that the Weizsacker-Williams approximation is inadequate for heavy projectiles. Using our estimates for the nuclear contribution, we find that the data yields good agreement with the Weizsacker-Williams results for virtually all projectile-target combinations. We therefore conclude that the measured deviations from the Weizsacker-Williams results do not represent new physics, but rather reflect uncertainties in the estimation of the nuclear contribution to the single nucleon removal process. As an elementary example of the possible new physics that may be observed in this process, we calculate the contributions from a coherent nuclear process and the possible interference effects. For heavy projectiles, we find that the interference effects are comparable to the present experimental uncertainties.

1820 Quasielastic (e,e') sum rule saturation. Chinn, C.R. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742 (US)); Picklesimer, A.; Van Orden, J.W. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1159-1174 (Sep 1989).

A microscopic Green's function doorway formalism is used to study Coulomb sum rule saturation in inclusive quasielastic electron scattering as a function of momentum transfer. Form factor, kinematical restriction, and final-state interaction effects on the approach to saturation are examined in detail, as are the roles of nonhermiticity, energy dependence, and the analytic behavior of the final-state interactions. The implications of relativistic kinematics and dynamics for the approach to saturation at not-too-high values of the momentum transfer are assessed. Because the pair production of relativistic treatments destroys the asymptotic nature of the nonrelativistic Coulomb sum rule, the degree to which a regime of validity can be expected for this sum rule, and its location, is considered. The breakdown of the sum rule as the momentum transfer increases is also examined. Similar theoretical studies of an analogous nonrelativistic transverse sum in its saturation region are developed as well. Theoretical predictions are compared with the experimental data for ^{40}Ca both directly and using a variety of theoretical prescriptions and limits. Neutron knockout contributions and associated uncertainties due to ambiguity in the free neutron form factors are examined.

1821 Linear momentum transfer in the reaction of 64–269 MeV ^{3}He with ^{238}U. Skulski, W. (Heavy Ion Laboratory, Warsaw University, Warsaw 02-097, Poland (PL)); Fatyga, M.; Karwowski, H.J.; Kwiatkowski, K.; Viola, V.E. Jr.; Hicks, K.; Ristinen, R. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1279-1290 (Sep 1989).

Angular correlations between binary fission fragments have been measured in coincidence with light charged particles for 64, 129, 199, and 269 MeV ^{3}He-induced reactions on a ^{238}U target. Linear momentum transfer and missing linear momentum have been determined for a broad range of light-charged-particle energies E_{LCP} and emission angles θ_{LCP}. Average momentum transfer increases from a fraction of beam momentum for small detection angles to nearly full momentum transfer at backward angles. The missing momentum depends primarily on "available energy" $E_{av}=E_{beam}-E_{LCP}$, but neither on beam energy E_{beam} nor light particle detection angle. Backward proton and deuteron emission is incompatible with statistical evaporation following complete or incomplete fusion.

1822 Velocity dependence of prompt, high-energy nucleon emission. Dean, D.J. (Department of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee 37235 (US)); Umar, A.S.; Strayer, M.R. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1213-1218 (Sep 1989). DOE Contract AC05-84OR21400.

A time-dependent entrance channel formalism, which treats the relative motion of the heavy ions classically, and the internal excitations quantum mechanically, is used to study prompt nucleon emission from deep-inelastic collisions of the ^{58}Ni+^{165}Ho system at E_{lab}=930 MeV. The calculations employ an external, time-dependent, one-body potential. We investigate the correlation between the most probable velocity of the heavy ions when the nucleons are emitted and the exit channel total kinetic energy of the system, and compare with experimental data. We found that the model predicts a source velocity for the ions which is 10% below the measured projectilelike fragment velocity, and 34% above the measured velocity for the prompt emission source.

1823 Microscopic *s*-wave optical potential for slow pions scattered by a nucleus. Garcia-Recio, C. (Center for Theoretical Physics, Laboratory for Nuclear Science Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Oset, E. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1308-1315 (Sep 1989).

We have done a microscopic calculation of the *s*-wave optical potential for the pion-nucleus system at low energies, $0\leq T_\pi \leq 100$ MeV, using a description based on hadronic degrees of freedom. We have obtained, separately, the real and imaginary parts of the optical potential coming from one-body and two-body processes. We have also separated the imaginary part of the potential associated to absorption and to quasielastic channels. We find that the imaginary part of the absorption channel is independent of the energy (within the range of energies considered here) in agreement with a recent empirical determination. We compare our results with phenomenological potentials obtained by fits to the empirical data. The comparison shows a good qualitative agreement. We discuss the dependence of the optical potential on the πN amplitudes, taken as an input in this model, and we find that a more repulsive isoscalar πN *s*-wave amplitude would provide better consistency between the π-nucleus theoretical results and the π-nucleus data.

New experiments to provide more accurate πN phase shifts at low energies would be welcome.

1824 Proton mean-free path in nuclear matter and in finite nuclei. Yuan, H.J. (Department of Physics, Kent State University, Kent, Ohio 44242 (US)); Lin, H.L.; Fai, G.; Moszkowski, S.A. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1448-1458 (Sep 1989).

The mean-free path of protons is calculated in nuclear matter and in finite nuclei using the extended Skyrme interaction. The Green's function technique is employed for infinite nuclear matter to carry out the calculations analytically. The connection to finite nuclei is established and results are compared to data extracted from reaction cross sections and optical-potential fits for three closed-shell nuclei. Fixing the radius parameter as in the interpretation of the measurements leads to reasonable agreement within the accuracy of the data.

1825 $0^+,T=0(p,p')0^-,T=1$ pion like excitations and nuclear response in the spin-isospin channel. Cohen, J. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106 (US)). *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1468-1478 (Sep 1989).

We discuss the importance of the $J^\pi=0^+,T=0\rightarrow J^\pi=0^-,T=1$ pion-like excitation in ^{40}Ca, comparing it with results for smaller nuclei. Spin-isospin strength distribution effects due to high-lying nucleon-hole and Δ-hole excitations combined with the Landau-Migdal residual interaction are studied in an exact finite-nucleus calculation. We also present a comparison with a Fermi gas calculation in the local density approximation. We find important renormalization effects including interesting enhancement and quenching for different regions of the momentum transfer, which may be relevant and useful in explaining available experimental results for light nuclei. We demonstrate that studies on heavier nuclei will give complementary information on the diamesic renormalization and finite-system effects in the spin-isospin mode that is not available in the case of smaller nuclei.

1826 Method for computing coupled-channels Gamow-state energies. He, G. (Physics Department, Oregon State University, Corvallis, Oregon 97331 (US)); Fink, P.; Landau, R.H. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1525-1526 (Sep 1989).

The bound states and resonances of a two-particle system occur at the complex energies for which the system's T matrix has poles. Presented is a more efficient method of computing these energies for symmetric potential interactions.

1827 New comparisons of the coupled-channel model with elastic deuteron form factors. Blunden, P.G. (Department of Physics, University of Manitoba, Winnipeg, Manitoba, Canada R3T2N2 (CA)); Greenberg, W.R.; Lomon, E.L. *Physical Review [Section] C: Nuclear Physics (USA),* 40(3): 1541-1544 (Sep 1989).

The coupled-channel model is compared to new, accurate measurements of the deuteron elastic electric structure function. The fit to previous elastic form-factor data is also shown because of small modifications arising from correcting the sign of a tensor term in the NN to $\Delta\Delta$ coupling potential. The improved fits give preference to the Gari-Kruempelmann nucleon electromagnetic form factors and also to the radius of asymptotic freedom of quarks corresponding to the cloudy bag model. The sensitivity of the choice of radius of asymptotic freedom to the result of the analysis of recent T_{20} data remains high.

6540 Radiation and Shielding Physics

Refer also to citation(s) 125, 452, 1220

1828 (CONF-890798–13) **Structural studies at high pressure using time-of-flight neutron powder diffraction.** Jorgensen, J.D. Argonne National Lab., IL (USA). Jul 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From AIRAPT and EHPRG international high pressure science and technology conference; Paderborn (Germany, F.R.); 17-21 Jul 1989. Order Number DE90002185. Avaiiable from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Time-of-flight neutron powder diffraction offers unique capabilities for structural studies at high pressure. Scientific applications have included studies of compression mechanisms, new high-pressure structures, and phase transitions. 11 refs., 1 fig.

1829 (CONF-8905231–1) **Structure and dynamics of disordered systems.** Price, D.L. Argonne National Lab., IL (USA). 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on neutron scattering days at Studsvik; Studsvik (Sweden); 22-24 May 1989. Order Number DE90001408. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Neutron scattering has proved to be a powerful tool in the study of glasses and liquids: structures are investigated by neutron diffraction, and dynamics by inelastic neutron scattering. Evidence of current interest in this field is provided by the new instruments for diffraction from amorphous systems being constructed at IPNS, ISIS and the R2-reactor at Studsvik, in addition to existing instruments such as the D4B diffractometer at ILL. 14 refs., 9 figs.

1830 (N–89-20642) **Hypercube matrix computation task. Report, 1986-1988.** Calalo, R.H.; Imbriale, W.A.; Jacobi, N.; Liewer, P.C.; Lockhart, T.G.; Lyzenga, G.A.; Lyons, J.R.; Manshadi, F.; Patterson, J.E. Jet Propulsion Lab., Pasadena, CA (USA). Aug 1988. 189p. (NASA-CR–184869;JPL-PUBL–88-31;NAS–1.26:184869). Available from NTIS, PC A09/MF A01.

A major objective of the Hypercube Matrix Computation effort at the Jet Propulsion Laboratory (JPL) is to investigate the applicability of a parallel computing architecture to the solution of large-scale electromagnetic scattering problems. Three scattering analysis codes are being implemented and assessed on a JPL/California Institute of Technology (Caltech) Mark 3 Hypercube. The codes, which utilize different underlying algorithms, give a means of evaluating the general applicability of this parallel architecture. The three analysis codes being implemented are a frequency domain method of moments code, a time domain finite difference code, and a frequency domain finite elements code. These analysis capabilities are being integrated into an electromagnetics interactive analysis workstation which can serve as a design tool for the construction of antennas and other radiating or scattering structures. The first two years of work on the Hypercube Matrix Computation effort is summarized. It includes both new developments and results as well as work previously reported in the Hypercube Matrix Computation Task: Final Report for 1986 to 1987 (JPL Publication 87-18).

1831 (ZfK–584, pp. 131) **Fortran code for the calculation of 'realistic' distributions of neutrons produced in hydrogen-isotope reactions.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Ruben, A. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. DEUTERIUM TARGET/neutrons; DEUTERIUM TARGET/particle production; NEUTRONS/computer codes; NEUTRONS/energy spectra; TRITIUM TARGET/neutrons; TRITIUM TARGET/particle production; ANGULAR DISTRIBUTION; NEUTRONS; DEUTERON REACTIONS; DIFFERENTIAL CROSS SECTIONS; ENERGY LOSSES; HELIUM 3; HELIUM 4; NEUTRON SPECTRA; PROTON REACTIONS; STOPPING POWER

1832 (ZfK–584, pp. 114) **Correlation between fission fragment absorption losses and the plateau height in fission chamber spectra.** Herbach, C.M. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Pausch, G. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear*

physics activities and applications. Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. FISSION CHAMBERS/fission fragments; FISSION FRAGMENTS/corrections; FISSION FRAGMENTS/range; ABSORPTION; CORRELATIONS; ENERGY LOSSES; ENERGY SPECTRA; EXTRAPOLATION; CORRECTIONS; RANGE; FOILS; SHAPE; STOPPING POWER; TARGETS

1833 (ZfK–584, pp. 132) **Implementation of an universal stopping power code to the ES 1055 computer.** Enghardt, W. (Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)); Henniger, J. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. STOPPING POWER/es computers; STOPPING POWER/s codes; ALPHA PARTICLES; COMPARATIVE EVALUATIONS; FORTRAN; IMPLEMENTATION; RANGE; SPECIFICATIONS; TARGETS; TIME-OF-FLIGHT METHOD

1834 **Radiation physics as a basis of radiation chemistry and biology.** Inokuti, Mitio (Argonne National Lab., IL (USA)). vp. of Applied atomic collision physics, Volume 4. Academic Press, Inc., New York, NY (US) (1983).

A basic review of radiation physics is presented. Chapter one presented an overview of the field. Chapter two covers effects on radiation as it passes through matter, and discusses applications to dosimetry and nuclear medicine. Chapter three discusses how matter changes when radiation passes through it. Radiation chemistry and biology are considered in chapter four and concluding remarks are given in chapter five.

1835 **Transport equations in weak topologies of dual Banach spaces.** Greenberg, W. (Department of Mathematics and Center for Transport Theory and Mathematical Physics, Virginia Polytechnic Institute and State Univeristy, Blacksburg, Virginia 24061 (US)); Polewczak, J. *Transport Theory and Statistical Physics (USA),* 18(1): 115-124 (Feb 1989).

Nonlinear transport equations are studied, in which the nonlinearity, arising from the collision operator, is well behaved in the weak topology of a weakly compactly generated Banach space. The Cauchy problem is posed for general semilinear evolution equations, which can model a variety of diffusion and kinetic equations. Local existence theorems are obtained for such spaces. In particular, the results are applicable to transport equations in L^∞ with appropriate weak (i.e., L^1) continuity properties.

1836 **Analytic solution of a five-direction radiation transport model.** Cramer, S.N. (Oak Ridge National Lab., TN (USA)). *Transactions of the American Nuclear Society (USA),* 57: 232-233 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

To test certain spatial and angular-dependent Monte Carlo biasing techniques, a one-dimensional, one energy, two-media, five-direction radiation transport model has been devised for which an analytic solution exists. Although this solution is too long to be conveniently expressed in an explicit form, it can be easily evaluated on the smallest of computers. The salient features of the solution are that it involves only a 4 x 4 determinant, a quadratic equation, and two sets of four linear algebraic equations. The Monte Carlo simulation of this transport model is very simple and also applicable to small computers. This model gives an analyst the ability to test certain features of biasing techniques and code generation of biasing parameters, involving directional dependence and changes in cross-section media through many mean-free-paths of particle penetration. The comparison of results with an exact solution associated with the solution of realistic calculations using general Monte Carlo codes on mainframe computers.

1837 **A discrete nodal transport method for cylindrical geometry.** Kim, S.T.; Dorning, J.J. *Transactions of the American Nuclear Society (USA),* 57: 233-235 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Various nodal methods for solving the discretized transport equation, referred to here collectively as discrete nodal transport methods (DNTMs), have been shown to be superior in computational efficiency to the S_N method. Although zeroth- and first-order multidimensional DNTMs have been developed and applied to fuel assembly, shielding, and well-logging problems, their development has been limited for the most part to Cartesian geometry, even though many practical problems are more realistically modeled in cylindrical geometry. The authors have developed constant-constant and linear-linear DNTMs for cylindrical geometry. The results show that they are accurate and have better computational efficiency than the S_N method. This is in contrast to another DNTM, developed previously for cylindrical geometry in which the metrics were approximated by constants and a different treatment of the angular redistribution term was used. In that work the authors concluded that their nodal method was less efficient than the S_N method. The present results establish the feasibility of developing efficient nodal transport methods for general curvilinear coordinates.

6550 Medical Physics

Refer also to citation(s) 504, 540

1838 (DOE/FTR–90001726) **[The safety of present and future nuclear power plants]: Foreign trip report, September 23, 1989–October 8, 1989.** Kouts, H. Brookhaven National Lab., Upton, NY (USA). 23 Oct 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90001726. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Scientific Programme held in parallel with the IAEA's General Conference had as its theme "The New Generation of Nuclear Power." I was asked by IAEA to deliver a paper during the programme on the meeting recently held in Chicago on "The Safety of Present and Future Nuclear Power Plants." I did so. Along with Harold Finger, I had a conversation with Dr. N. Shteinberg, who is Deputy Chairman of the USSR State Committee for the Supervision of Nuclear Power Safety. This conversation is reported in detail in the body of the report.

1839 (EGG-M–00688) **US Department of Energy Laboratory Accreditation Program for personnel dosimetry systems (DOELAP).** Carlson, R.D.; Gesell, T.F.; Kalbeitzer, F.L.; Roberson, P.L.; Jones, K.L.; MacDonald, J.C.; Vallario, E.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880404–21: 7. international congress of the International Radiation Protection Association (IRPA), Sydney (Australia), 10-17 Apr 1988). Order Number DE90002002. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The US Department of Energy (DOE) Office of Nuclear Safety has developed and initiated the DOE Laboratory Accreditation Program (DOELAP) for personnel dosimetry systems to assure and improve the quality of personnel dosimetry at DOE and DOE contractor facilities. It consists of a performance evaluation program that measures current performance and an applied research program that evaluates and recommends additional or improved test and performance criteria. It also provides guidance to DOE, identifying areas where technological improvements are needed. The two performance evaluation elements in the accreditation process are performance testing and onsite assessment by technical experts. Performance testing evaluates the participant's ability to accurately and reproducibly measure dose equivalent. Tests are conducted in accident level categories for low- and high-energy photons as well as protection level categories for low- and high-energy photons, beta particles, neutrons and mixtures of these.

1840 (EPA–520/5-89-008) **The Eastern Environmental Radiation Facility's participation in interlaboratory and intralaboratory comparisons of environmental sample analyses,**

1981–1986. Moore, J.; Broadway, J.; Blanchard, R. Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility. Aug 1989. 152p. Sponsored by Environmental Protection Agency. Available from OSTI; INIS; US Environmental Protection Agency, 401 M St., SW, Washington, DC 20460.

This report compiles the results of the interlaboratory of the interlaboratory and intralaboratory quality assurance programs for the EERF's analytical chemistry laboratory during 1981 through 1986. The interlaboratory program, which consisted of participating in cross-check analyses with the EPA's EMSL-LV laboratory, the World Health Organization, and the Mound Facility, resulted in 544 analyses. The intralaboratory program consisted of 486 blind sample analyses and 2523 replicate sample analyses. Cross-check and blind sample analyses were considered acceptable when the result of the analysis was within 20 percent of the known concentration. Some results that differed by more than 20 percent were judged to be acceptable because of low sample concentrations, the uncertainty in the measurement and known value, and the small absolute difference. The distribution of the analytical precision, determined by performing 2523 replicate analyses (every tenth sample), was similar to but somewhat less, about 7 percent, than the expected theoretical distribution. 10 refs., 7 figs., 14 tabs.

1841 On the influence of the exposure model on organ doses. Drexler, G.; Eckerl, H. *Transactions of the American Nuclear Society (USA),* 57: 215-216 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Based on the design characteristics of the MIRD-V phantom, two sex-specific adult phantoms, ADAM and EVA were introduced especially for the calculation of organ doses resulting from external irradiation. Although the body characteristics of all the phantoms are in good agreement with those of the reference man and woman, they have some disadvantages related to the location and shape of organs and the form of the whole body. To overcome these disadvantages related to the location and shape of organs and form of the whole body. To overcome these disadvantages related to the location and shape of organs and the form of the whole body. To overcome these disadvantages and to obtain more realistic phantoms, a technique based on computer tomographic data (voxel-phantom) was developed. This technique allows any physical phantom or real body to be converted into computer files. The improvements are of special importance with regard to the skeleton, because a better modeling of the bone surfaces and separation of hard bone and bone marrow can be achieved. For photon irradiation, the sensitivity of the model on organ doses or the effective dose equivalent is important for operational radiation protection.

1842 Anthropomorphic phantoms. Egbert, S.D. *Transactions of the American Nuclear Society (USA),* 57: 216-217 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The anthropomorphic phantom is a constructed model using significant internal and external features of the human form. It is used in radiation shielding studies to more accurately determine the dose and spectral perturbations resulting from the presence of body tissues lying between internal or external sources and the organs of interest. Anthropomorphic phantoms are either physical, and thus used in experimental configurations, or mathematical, and thus used with radiation transport codes. Adequate anthropomorphic phantoms should be used, to more accurately obtain doses in real exposure situations. Calculational techniques exist that help to overcome the difficulties caused by using the more complicated geometries.

1843 The effect of gender and remainder on effective dose equivalent. Tanner, J.E. *Transactions of the American Nuclear Society (USA),* 57: 217-218 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Effective dose equivalent methodology, as recommended by the International Commission on Radiological Protection in ICRP-26, may be implemented for routine evaluation of occupational exposures to external sources of penetrating radiation, such as neutrons and photons. The calculational techniques for determining effective dose equivalent are being developed and evaluated at Pacific Northwest Laboratories. These studies show that the estimated effective dose equivalent is strongly influenced by several factors, including the source energy, source geometry, phantom gender type, and remainder scheme used. Since the concept of effective dose equivalent relies on determining organ doses, the organ doses for these studies were calculated using the MIRD-V mathematical phantom and MCNP, a general-purpose Monte Carlo neutron and photon transport code. Calculations of organ doses were performed for several irradiation geometries at a series of energies from 10 keV to 10 MeV. The geometries were the anterior-posterior (AP) parallel beam, the posterior-anterior parallel beam, the lateral parallel beam, and an isotropic field. These calculations were performed for both the male and female phantoms. For whole-body irradiations, the use of sex-specific weighting factors instead of the average values can result in large differences in the effective dose equivalent. The largest differences were found for the case of the male phantom in an AP beam.

1844 Dose equivalent and phantoms in conventional calibration practice. Hertel, N.E.; McDonald, J.C. *Transactions of the American Nuclear Society (USA),* 57: 219-221 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The International Commission on Radiation Units and Measurements (ICRU) Report 39 recommends that several new dose equivalent quantities be used and that, to calibrate dosimeters and instruments in terms of these new quantities, the ICRU sphere be used as a phantom. Currently, the calibration of personnel dosimeters in both the US Department of Energy's Laboratory Accreditation Program (DOELAP) and National Voluntary Laboratory Accreditation Program (NVLAP) testing programs is performed using rectangular polymethylmethacrylate (PMMA) phantoms. The relationship of dose equivalent in the calibration procedures set by these two standards was investigated by comparing the dose equivalent calculated for a personnel dosimeter placed on a slab phantom to the ambient dose equivalent, $H^*(10)$. Although the individual dose equivalent, penetrating, is the actual quantity that should be simulated with a personnel dosimeter, in calibration and testing practice, the two are numerically equal for normal irradiation on the front face of the phantom.

1845 Calibration of individual neutron monitors in terms of H_p and the new ICRU dose-equivalent quantities. Siebert, B.R.L.; Jahr, R. *Transactions of the American Nuclear Society (USA),* 57: 221 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The effective dose equivalent H_p is considered as a primary limiting quantity in radiation protection. The value H_p is considered as a primary limiting quantity in radiation protection. The value H_p is the sum of weighted organ dose equivalents and allows the effects of internal (ingestion and inhalation) and external irradiation to be accounted for. In routine radiation practice, H_p, as defined in each individual, is far too complicated and needs to be estimated by well-defined quantities such as H_p', as defined in an anthropomorphic phantom, or the new International Commission on Radiation Units and Measurements quantities, which use a 30-cm-diam tissue-equivalent sphere as a phantom for defining. This chain from the complicated individual effective dose equivalent to simple operational dose equivalent is described here as mapping, and the requirements to be placed on operational quantities are discussed. This paper is restricted to external irradiation with neutrons since they are more apt to demonstrate the basic problems of calibrating. The aim of this paper is to discuss the simultaneous mapping of dose equivalent and neutron fluence and use a theoretical concept for measuring doses from external sources for radiation protection to give a consistent description of calibration and practical use of neutron dosimeters.

1846 A comparison of TLD and Monte Carlo calculation for beta dosimetry. Hoffman, J.M.; Ben-Shacher, B.; Levine, S.H. *Transactions of the American Nuclear Society (USA),* 57: 221-222 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Beta particle radiation, which always has a low-penetrating component, is strongly absorbed by the skin, i.e., at a depth of 7 mg/cm^2. The major problem in using thermoluminescent dosimeters (TLDs) for beta dosimetry is that the TLD chips have finite thickness and sometimes their response is nonlinear with beta energy. A new method of determining the beta dose to the skin has been investigated by combining analytic calculations with experimental measurements. The analysis was performed with an experimentally verified Monte Carlo computer program based on electron-transport theory and beta spectrometry. The experimental measurements were made with $Li_2B_4O_7$:Cu phosphors having different polyethylene shields and an extrapolation chamber. In the present work the authors used the Panasonic UD-806 badges, which contain four $Li_2B_4O_7$:Cu phosphors, shielded by 2, 49, 160, and 160 of mg/cm^2 of polyethylene. The energy deposited by electrons in $Li_2B_4O_7$:Cu, shielded by different layers of polyethylene, as a function of the dept, was calculated by using the Monte Carlo electron transport code ZEBRA developed by Berger. Excellent agreement is found between the calculated and measured ratios for any two different shielded phosphors, for both sources, except for the ratios of ^{204}T1 spectrum when the shield of 77 mg/cm is involved.

1847 Anthropomorphic phantom radiation dosimetry at 400 m from a fission source. Cousins, T.; Kaul, D.C. *Transactions of the American Nuclear Society (USA)*, 57: 218-219 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The relationship between the measured value of dose, as registered by a dosimeter at a particular location on a soldier's body, to free-field kerma is of particular importance to the military when parameters such as performance decrement or mortality must be ascertained. Calculations have been made to derive this relationship for specific nuclear weapons environments; however, experimental verification of these results in these exact environments is impossible. In order to lend credance to these computer calculations, a series of experiments was conducted at the North Atlantic Treaty Organization's standard reference point-400 m from the critical assembly at Aberdeen Proving Ground (APG) in Maryland. The phantom chosen for these measurements was the Humanoid RT-200. The theoretical calculations were performed using the computer code VCS. A forward DOT calculation gave the free-field energy spectra and kerma. The adjoint MORSE method within VCS then allowed calculation of the appropriate energy spectra at the dosimeter locations on a computer-simulated anthropomorphic phantom (RT-200). The dosimeter responses were then predicted by folding these spectra into the measured detector kerma/energy response curves. Comparisons were performed between measured and calculated data to provide a benchmark for verifying and validating the applicable calculational methods and for better understanding the measured data.

6560 Condensed Matter Physics

Refer also to citation(s) 900, 1068, 1212, 1868

1848 (CONF-881155–44) **X-ray microprobe for the microcharacterization of materials.** Sparks, C.J.; Ice, G.E. Oak Ridge National Lab., TN (USA). 1988. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Fall meeting of the Materials Research Society; Boston, MA (USA); 28 Nov - 3 dec 1988. Order Number DE89006038. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The unique properties of x rays offer many advantages over those of electrons and other charged particles for the microcharacterization of materials. X rays are more efficient in exciting characteristic x-ray fluorescence and produce higher fluorescent signal-to-background ratios than obtained with electrons. Such x-ray microprobes will also produce unprecedentedly low levels of detection in diffraction, EXAFS, Auger, and photoelectron spectroscopies for structural and chemical characterization and elemental identification. These major improvements in microcharacterization capabilities will have wide-ranging ramifications not only in materials science but also in physics, chemistry, geochemistry, biology, and medicine. 24 refs., 6 figs., 2 tabs.

1849 (CONF-891117–9) **Magnetic excitations in thulium metal.** Fernandez-Baca, J.A.; Nicklow, R.M.; Rhyne, J.J. Oak Ridge National Lab., TN (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989. Order Number DE90002475. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have performed inelastic neutron scattering measurements on a single crystal specimen of Tm at wavevectors $\vec{\kappa} = (1,1,\zeta)$ and $(0,0,2+\zeta)$ ($\zeta = 0, \cdots, 1$). Most of the measurements have been made at T = 5K, where Tm exhibits a seven layer ferrimagnetic-antiphase-domain structure (four moments up, parallel to the c-axis, followed by three moments down). At this temperature the excitation spectra consist of three peaks. The two lower energy excitations have been identified as originating from magneto-vibrational scattering from the TA phonon, while the higher energy excitation is magnetic and exhibits only a weak dispersion (between 8.3 and 9.6 meV). At T = 50K, a temperature at which the system exhibits a c-axis sinusoidally modulated structure, the magnetic mode shows significant softening and broadening. The magneto-vibrational scattering vanishes above the Neel temperature (T_N = 58.5K) while the magnetic mode persists at least up to T = 70K. These results suggest that the Hamiltonian in this system is dominated by the crystal-field-anistropy energy, and that the exchange interaction is relatively weak. 9 refs., 2 figs.

1850 (CONF-8804141–) **The 11th Werner Brandt workshop on charged particle penetration phenomena.** Oak Ridge National Lab., TN (USA). Sep 1989. 299p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 11. Werner Brandt workshop on charged particle penetration phenomena; Oak Ridge, TN (USA); 14-15 Apr 1988. Order Number DE90000959. Available from NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

This report contains the following papers: energy loss of a charged particle moving near the surface of a superlattice; image states on insulators; potential barrier for tunneling electrons in STM; elastic and inelastic interaction in STEM; excitonic interaction in GaAs/GaAlAs quantum wells; recoil saturation of the self-energy in atomic systems; review of convoy electron phenomena; transport theory for convoy electrons and Rydberg electrons in solids; electron emission from collective excitation of solids by heavy ion impact; ECC cusp shapes for H^+ and He^{++} on atomic and molecular targets; scanning tunneling microscopy and spectroscopy; new directions in scanning-tunneling microscopy; inner-shell excitation by channeled electrons; Cherenkov x-rays: recent experimental results; radiative electron capture; optical, mass, and auger spectra from e-bombarded KBr; calculated Bethe stopping powers for protons in metals; energy deposition by partially stripped ions; enhanced electron-capture and charge variation of molecular ions; electronic sputtering; mechanism of H_n^+ and H^- desorption during fast ion bombardment; on the calculation of wave-number vector- and frequency-dependent dielectric response function for cubic ice; a core plasma model of track structure in insulators; phase effects for electrons in liquid water and water vapor; physical and chemical interactions in irradiated water containing DNA; track core effects in heavy ion radiolysis; an analytic representation of the radial distribution of dose from energetic heavy ions in water, Si, LiF, and NaI; and calculated yields of ammonia in the radiolysis of deoxygenated solutions of glycylglycine.

1851 (DOE/ER/45231–4) **SUNY X-3 beamline at NSLS [National Synchrotron Light Source].** Coppens, P. State Univ. of New York, Buffalo, NY (USA). Dept. of Chemistry. [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45231. Order Number DE90001708. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Research is briefly described in the following areas: crystallography of superconductors, organic nitrogen compounds, monocrystals, and quasicrystals; small angle scattering of polystyrene and sulfonated polystyrene ionomers, gelatin in sol and in gel, poly (p-phenylene terephthalamide), polydiacetylene, evaluation of a photodiode array detector; EXAFS studies of microstructures in semiconductor and superconducting materials, studies of heterostructures, and x-ray detector testing and experimentation. 21 refs. (CBS)

1852 (LA-UR-89-3008) **Lanczos diagonalizations of the 1-D Peierls-Hubbard model.** Loh, E.Y.; Campbell, D.K.; Gammel, J.T. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-8810299–5: Interacting electrons in reduced dimensions, Torino (Italy), 3-7 Oct 1988). Order Number DE90000537. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In studies of "interacting electrons in reduced dimensions" one is trapped between the Scylla of exponential growth of the number of states in any exact many-body basis and the Charybdis of the failure of mean-field theories to capture adequately the effects of interactions. In the present article we focus on one technique – the Lanczos method – which, at least in the case of the 1-D Peierls-Hubbard model, appears to allow us to sail the narrow channel between these two hazards. In contrast to Quantum Monte Carlo methods, which circumvent the exponential growth of states by statistical techniques and importance sampling, the Lanczos approach attacks this problem head-on by diagonalizing the full Hamiltonian. Given the restrictions of present computers, this approach is thus limited to studying finite clusters of roughly 12–14 sites. Fortunately, in one dimension, such clusters are usually sufficient for extracting many of the properties of the infinite system provided that one makes full use of the ability to vary the boundary conditions. In this article we shall apply the Lanczos methodology and novel "phase randomization" techniques to study the 1-D Peierls-Hubbard model, with particular emphasis on the optical absorption properties, including the spectrum of absorptions as a function of photon energy. Despite the discreteness of the eigenstates in our finite clusters, we are able to obtain optical spectra that, in cases where independent tests can be made, agree well with the known exact results for the infinite system. Thus we feel that this combination of techniques represents an important and viable means of studying many interesting novel materials involving strongly correlated electrons. 26 refs., 6 figs.

1853 (ORNL/FTR–3422) **[Surface engineering by high energy beams]: Foreign trip report, September 23–October 6, 1989.** McHargue, C.J. Oak Ridge National Lab., TN (USA). 23 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001296. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A paper entitled "Structure-Mechanical Property relationships in Ion-Implanted Ceramics" was presented at the 2nd International Seminar on Surface Engineering by High Energy Beams in Lisbon, Portugal. This seminar was sponsored by the International Federation of Heat Treatment and Surface Engineering and included discussions on surface modifications using laser, electron, and ion beams. The visit to the University of Lisbon and LNETI-Sacavem included discussions regarding collaborative research in which Professor J.C. Soares and Dr. M.F. da Silva would conduct perturbed angular correlation (PAC) studies on ion-implanted samples supplied by the traveler. The collaboration between researchers at ORNL and the University Claude Bernard-Lyon 1 (France) continues. Data were analyzed during this visit, plans for further experiments were developed, and a paper was drafted for publication.

1854 (ZfK–584, pp. 84) **RBS investigations of defects in weakly damaged GaAs.** Wesch, W. (Jena Univ. (German Democratic Republic). Sektion Physik); Gaertner, K.; Wendler, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GALLIUM ARSENIDES/displacement rates; GALLIUM ARSENIDES/ion implantation; BACKSCATTERING; DEPTH; DISTANCE; HELIUM ISOTOPES; ION BEAMS; LAYERS; NITROGEN ISOTOPES; POINT DEFECTS; RUTHERFORD SCATTERING; SPATIAL DISTRIBUTION; TEMPERATURE DEPENDENCE

1855 (ZfK–584, pp. 83) **Defects in laser annealed ion implanted GaAs layers.** Wesch, W. (Jena Univ. (German Democratic Republic). Sektion Physik); Ressel, P.; Wendler, E. Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic); Leipzig Univ. (German Democratic Republic); Humboldt-Universitaet, Berlin (German Democratic Republic); Jena Univ. (German Democratic Republic); Bergakademie, Freiberg (German Democratic Republic). Apr 1986. In *Annual report 1985 on nuclear physics activities and applications.* Order Number DE90705936. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Short note. GALLIUM ARSENIDES/ion implantation; GALLIUM ARSENIDES/physical radiation effects; ABSORPTION; ANNEALING; CRYSTAL DEFECTS; LASER RADIATION; LAYERS; PRESSURE DEPENDENCE; VACANCIES

1856 **Behavior of a quantum particle in contact with a classical heat bath.** Nielaba, P. (Rutgers, The State Univ. of New Jersey, New Brunswick (USA)); Lebowitz, J.L.; Spohn, H.; Valles, J.L. *Journal of Statistical Physics (USA),* 55(3-4): 745-767 (May 1989). DOE Contract FG02-88ER25053.

The authors investigate the behavior of a two-level quantum system in contact with a classical heat bath, e.g., a solute particle with internal degrees of freedom immersed in a solvent of massive particles. Using a combination of analytical and numerical methods, they obtain precise information about localization, time-displaced correlation functions, and the frequency-dependent susceptibility of such solute particles. They find that these quantities can have a strong dependence on the density of the solvent fluid, with the maximum changes from the behavior of the corresponding isolated quantum system occurring in many cases at very low densities. They compare the exact results with those obtained by path integral Monte Carlo. There is good agreement with the imaginary time correlations, but analytic continuation to real time proves elusive: even with the best numerical data on the former, they can only get very gross features of the latter.

1857 **Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials.** Hu, B. (Brookhaven National Laboratory, Upton, New York 11973 (US)); Jones, K.W.; Tebbe, F.N.; Firment, L.E.; Brixner, L.H. *Journal of Materials Research (USA),* 4(4): 916-922 (Jul 1989). DOE Contract AC02-76CH00016.

Trace oxygen contamination of metal fluoride glasses degrades their performance in applications such as optical fibers or x-ray phosphors. Traditional methods for oxygen determination based on reaction with carbon to form carbon monoxide are slow and insensitive. We have used nuclear reaction analysis, in particular the $^{18}O(p, \alpha)$ reaction, to determine oxygen content in a variety of metal fluorides. Careful choice of the energy of the incident proton eliminates interference from fluorine. Standardless quantification of our measurements yields good agreement with the known oxygen content of mixtures of oxides and fluorides and with several (non-fluoride) NBS standards over four orders of magnitude. Measurement of 30 ppm oxygen has been demonstrated.

1858 **Collective modes in Ising lattices.** Percus, J.K. (New York Univ., NY (USA)). *Journal of Statistical Physics (USA),* 55(5-6): 1263-1277 (Jun 1989).

The effect of collective modes on the otherwise local structure of Ising lattices is investigated by studying a number of exactly solvable models. First, the open one-dimensional Ising model serves to define sharp locality. This feature then remains upon extension to a Bethe lattice, despite the existence of a phase transition. But insertion of periodic boundary conditions creates a collective mode which breaks locality in a very specific fashion. A model interface is analyzed to show that even when locality is not broken, local uniformity can become untenable.

1859 **Acceleration instability in elastic-plastic solids. II. Analytical techniques.** Robinson, A.C. (Department of Solid Dynamics, Sandia National Laboratories, Albuquerque, New Mexico 87185-5800 (US)); Swegle, J.W. *Journal of Applied Physics (USA),* 66(7): 2859-2872 (1 Oct 1989). DOE Contract AC04-76DP00789.

Acceleration instability occurs when a body is accelerated by surface tractions. This situation resembles classic Rayleigh–Taylor instability, but differs due to the temporal and spatial variation of the stress field in the accelerated body caused by wave propagation

and the time dependence of accelerating forces. We wish to investigate the extent to which the acceleration instability response of elastic-plastic solids can be approximately modeled using a modal or one-degree-of-freedom technique assuming incompressible flow. We find that neither the response equation derived assuming a linear elastic shear response nor the so-called "minimum amplitude" instability criterion derived from rigid plastic analyses is sufficient to describe overall stability characteristics at very large driving pressures. Several versions of the modal approximation technique for an elastic-plastic material response are derived and compared. The features which must be included in such an analysis in order to obtain qualitative agreement with instability results seen in numerical experiments are indicated. However, quantitative agreement with numerical results cannot be obtained in all cases. The sources of the disagreement and the regions of applicability of the analysis are discussed.

1860 **Acceleration instability in elastic-plastic solids. I. Numerical simulations of plate acceleration.** Swegle, J.W. (Department of Solid Dynamics, Sandia National Laboratories, Albuquerque, New Mexico 87185-5800 (US)); Robinson, A.C. *Journal of Applied Physics (USA),* 66(7): 2838-2858 (1 Oct 1989). DOE Contract AC04-76DP00789.

Acceleration instability occurs when a body is accelerated by surface tractions. This situation resembles classic Rayleigh–Taylor instability, but differs due to the temporal and spatial variation of the stress field in the accelerated body caused by wave propagation and the time dependence of the accelerating forces. These factors produce phenomena in acceleration instability which are without precedent in classical Rayleigh–Taylor analyses. An extensive numerical study of acceleration instability using a Lagrangian finite-difference wavecode has determined the influence of various parameters including amplitude and wavelength of initial surface perturbations, material yield strength, and time dependence of the driving force. The nature of the criteria determining stability or instability is established, and the fundamental physical quantity controlling perturbation growth at an interface is shown to be the local stress gradient.

1861 **Model of plasma immersion ion implantation.** Lieberman, M.A. (Department of Electrical Engineering and Computer Sciences and the Electronics Research Laboratory, University of California, Berkeley, California 94720 (US)). *Journal of Applied Physics (USA),* 66(7): 2926-2929 (1 Oct 1989).

In plasma immersion ion implantation, a target is immersed in a plasma and a series of negative high-voltage pulses are applied to implant plasma ions into the target. We develop an approximate analytical model to determine the time-varying implantation current, the total dose, and the energy distribution of the implanted ions.

1862 **Measurement of the occupation lengths of channeled 17-MeV electrons and 54-MeV electrons and positrons in silicon by means of channeling radiation.** Kephart, J.O. (Xerox Palo Alto Research Center, Palo Alto, California 94304 (US)); Pantell, R.H.; Berman, B.L.; Datz, S.; Park, H.; Klein, R.K. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 4249-4263 (1 Sep 1989).

The occupation length of channeled 17-MeV electrons and 54-MeV electrons and positrons in silicon has been determined by measuring the intensity of the emitted channeling radiation. For 17-MeV electrons the measured $1/e$ occupation lengths are approximately 16 μm for the (100) plane and 20 μm for the (110) plane. For 54-MeV electrons the occupation lengths are 24 μm for the (100) plane and 36 μm for the (110) plane. For 54-MeV positrons the occupation lengths are 40, 60, and 42 μm for the (100), (110), and (111) planes, respectively. In all cases, the bound-state populations remain equal relative to one another throughout the thickness of the crystal. Multiple scattering appears to modify positron channeling radiation spectra slightly, but multiple scattering has no perceptible influence upon electron channeling radiation spectra.

1863 **Anomalous diffusion in a lattice-gas wind-tree model.** Kong, X.P. (The Rockefeller University, 1230 York Avenue, New York, New York 10021 (US)); Cohen, E.G.D. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 4838-4845 (1 Sep 1989).

Two new strictly deterministic lattice-gas automata derived from Ehrenfest's wind-tree model are studied. While in one model normal diffusion occurs, the other model exhibits abnormal diffusion in that the distribution function of the displacements of the wind particle is non-Gaussian, but its second moment, the mean-square displacement, is proportional to the time, so that a diffusion coefficient can be defined. A connection with the percolation problem and a self-avoiding random walk for the case in which the lattice is completely covered with trees is discussed.

1864 **Paired-magnon analysis of quantum antiferromagnets.** Manousakis, E. (Department of Physics, Center for Materials Research and Technology Supercomputer Computations Research Institute, Florida State University, Tallahassee, Florida 32306 (US)). *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 4904-4912 (1 Sep 1989).

We study the spin-1/2 Heisenberg antiferromagnet on an infinite square lattice. The calculational scheme known as "paired-phonon analysis" developed for strongly correlated quantum fluids is extended to a "paired-magnon analysis" to study quantum antiferromagnets. We define a complete and orthonormal set of multimagnon states and calculate the matrix elements of the Hamiltonian using a separability approximation. Our results obtained by diagonalizing the Hamiltonian matrix analytically are very similar to those obtained in spin-wave theory. We obtain -0.3290, for the ground-state energy per bond in units of the antiferromagnetic coupling and 0.303 for the ground-state staggered magnetization. These results compare well with the best-known estimates -0.334 ± 0.001 and 0.313, respectively. We derive the analytic form of the ground-state wave function in this approximation and find it to be of the same form as that assumed by Marshall in his variational studies.. The zero-point motion of long-wavelength excitations (spin waves) in the model, however, reflects a long-range tail in our wave function. We discuss the separability approximation by giving quantitative arguments which justify its validity.

1865 **Short-range order in Ising-like models with many-body interactions: Description via effective pair interactions.** Schweika, W. (Institut fur Festkorperforschung der Kernforschungsanlage Julich, D-5170 Julich, Federal Republic of Germany (DE)); Carlsson, A.E. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 4990-4999 (1 Sep 1989).

The validity of approximating the effects of many-body interactions in Ising-type models by several types of pair interactions is examined. In addition to the bare pair interaction (P_0), two interactions derived via high-temperature approximations are considered. The first (P_1) is concentration dependent and is obtained by an expansion to first order in inverse temperature; the second (P_2), obtained by a second-order expansion, is both temperature and concentration dependent. The validity of the pair approximations is evaluated by Monte Carlo calculations of ordering and thermodynamic properties for a particular many-body interaction model on a fcc lattice. In the high-temperature limit, the structure (as described by pair and multiple correlation functions) is accurately obtained by both the interactions P_1 and P_2, but not by P_0. Over a much wider range of temperatures, P_2 still yields accurate results. However, none of the pair interaction models obtain accurate mixing enthalpies. The connections that are derived between the strength of the many-body interactions, and the environmental dependence of the effective pair interactions, provide a possible way of evaluating the importance of the many-body interactions in solid solutions from diffuse scattering measurements.

1866 **Bosonic mean-field theory of quantum Heisenberg spin systems: Bose condensation and magnetic order.** Sarker, S. (Department of Physics and Astronomy, University of Alabama, P.O. Box 1921, Tuscaloosa, Alabama 35486-1921 (US)); Jayaprakash, C.; Krishnamurthy, H.R.; Ma, M. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5028-5035 (1 Sep 1989).

We discuss the mean-field approach to the quantum Heisenberg ferromagnet and antiferromagnet on bipartite lattices using the Schwinger boson representation, with the constraints imposed on the average. The low-dimensional results of Arovas and Auerbach [Phys. Rev. B. 38, 316 (1988)] are derived simply by using a Hartree-Fock decomposition and the Peierls variational principle. We study the models below their critical temperatures in three

dimensions (and at zero temperature in $d=2$ dimensions) by identifying magnetic ordering with Bose condensation of the Schwinger bosons. This novel interpretation enables us to compute the low-temperature (in the ordered regime) thermodynamic properties and dispersion relations, which agree with the results of spin-wave theory. We also extract critical properties that are related to those of the spherical model. A brief discussion of the limitations of the approach is also presented.

1867 **Model for a decorated twin boundary in ferroelastic martensites.** Mazor, A. (Center for Nonlinear Studies and Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Bishop, A.R. *Physical Review [Section] B: Condensed Matter (USA)*, 40(7): 5084-5093 (1 Sep 1989).

The structure of static $(1\bar{1}0)$ solitary twin boundaries of cubic-tetragonal martensitic transformations in ferroelastic materials is calculated at all temperatures below the first-order transition temperature. These solutions also describe uniformly moving coherent $(1\bar{1}0)$ twin boundaries. These calculations are based on a nonlinear and nonlocal three-dimensional continuum model, with a two-component strain order parameter. The results relate to a special physical situation with a continuous distribution of dislocations decorating the twin boundary. Approaching the first-order transition temperature from below, the tetragonal-tetragonal solitary domain wall splits gradually into two cubic-tetragonal solitary domain walls of finite width. Their separation, however, diverges at the transition temperature. Above this temperature no stationary solutions are found, which may imply the possible existence of dynamic solutions with nontrivial (i.e., nontraveling-type) time dependence. Numerical experiments indicate that these dynamic solutions have a pulse shape and not a kink shape.

6561 Superconductivity

Refer also to citation(s) 776, 821, 837, 847, 848, 849, 851, 853, 854, 855, 856, 859, 860, 861, 862, 864, 1010, 1011, 1012, 1016

1868 (BNL–43198) **Neutron scattering studies of magnetic correlations in the layered cuprates.** Tranquada, J.M.; Shirane, G. Brookhaven National Lab., Upton, NY (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890718–32: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, CA (USA), 23-28 Jul 1989). Order Number DE90002457. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

All of the copper oxide superconductors contain CuO_2 layers which, when insulating, exhibit strong, two-dimensional (2D) antiferromagnetic correlations due to the unusually large superexchange interaction between nearest-neighbor Cu^{2+} atoms. Magnetic correlations survive, although with a reduced correlation length, even when the layers are doped with holes. A short review of neutron scattering studies of magnetic correlations and excitations in the layered cuprates is presented. 19 refs., 6 figs.

1869 (CONF-890335–269) **Charge transfer and bond lengths in $YBa_2Cu_{3-x}M_xO_{6+y}$.** Jorgensen, J.D.; Rhyne, J.J.; Neumann, D.A.; Miceli, P.F.; Tarascon, J.M.; Greene, L.H.; Barboux, P. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90002241. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We discuss the effects of doping on the Cu chain sites in $YBa_2Cu_{3-x}M_xO_{6+y}$. The relationship between bond lengths obtained from neutron scattering and charge transfer is evaluated in terms of bond valence. In particular, it is concluded that removing an oxygen from the chains transfers one electron to the planes. 24 refs., 3 figs.

1870 (CONF-890971–5) **Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy.** Geohegan, D.B.; Mashburn, D.N. Oak Ridge National Lab., TN (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Conference on superconductivity and applications; Buffalo, NY (USA); 19-21 Sep 1989. Order Number DE90001968. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Transient optical absorption spectroscopy, a new diagnostic technique for examining the density of ground state neutrals and ions following laser ablation, has been utilized for the first time to study the transport of ground state Y, Ba, Cu, Y^+, and Ba^+ following laser ablation of $Y_1Ba_2Cu_3O_x$ pellets under film deposition conditions. The technique reveals significantly broadened velocity distributions with a low velocity component which is absent from velocity distributions inferred from monitoring excited state plume fluorescence. Ion probe measurements confirm this low velocity component. High resolution emission spectroscopy is also utilized to examine the spectral broadening arising from collision processes in the laser plasma as well as obtain estimates of plasma densities. 10 refs., 6 figs.

1871 (IRIM–8801) **Researches on amorphous perovskite.** National Inst. for Researches in Inorganic Materials, Tsukuba, Ibaraki (Japan). 21 Nov 1988. 98p. (In Japanese). Order Number DE89900733. Available from NTIS (US Sales Only), PC A05/MF A01.

Researches on amorphous perovskite were conducted and thereby the quenching production of fragile oxide by a soft roller method was made possible. The film of $KNbO_3$ added with other materials were produced by this method. These films have the possibility to develop to the infrared detection element. In addition, the film sample has large electrical resistivity. The quenching method is now applied to the oxide superconductive materials, and films of small critical current and of 100% density are being produced. As for the researches on high temperature superconductors; researches on crystal chemistry of La-Sr system were conducted, tetragonal and rhombic Y-Ba system was researched and its pressure effect was studied, and then their relations with the average values of T_c and Cu were studied using solid solution. The value of pressure effect of Bi system determined here was quite contrary to the predicted value by the RVB theory. In the study of high pressure composition of sulfide which was conducted with the purpose of producing superconductive perovskite compound, sulfide proved to be hard to become perovskite. 154 refs., 134 figs., 27 tabs.

1872 (LA-UR–89-3336) **MX chains: 1-D analog of CuO planes?.** Gammel, J.T.; Batistic, I.; Bishop, A.R.; Loh, E.Y. Jr.; Marianer, S. Los Alamos National Lab., NM (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890953–10: International conference on the physics of highly correlated electron systems, Santa Fe, NM (USA), 11-15 Sep 1989). Order Number DE90002438. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We study a two-band Peierls-Hubbard model for halogen-bridged mixed-valence transition metal linear chain complexes (MX chains). We include electron-electron correlations (both Hubbard and PPP-like expressions) using several techniques including calculations in the zero-hopping limit, exact diagonalization of small systems, mean field approximation, and a Gutzwiller-like Ansatz for quantum phonons. The adiabatic optical absorption and phonon spectra for both photo-excited and doping induced defects (kinks, polarons, bipolarons, and excitons) are discussed. A long period phase which occurs even at commensurate filling for certain parameter values may be related to twinning. The effect of including the electron-phonon in addition to the electron-electron interaction on the polaron/bipolaron (pairing) competition is especially interesting when this class of compounds is viewed as a 1-D analog of high-temperature superconductors. 6 refs., 4 figs.

1873 (LA-UR–89-3499) **Electronic structure of monoclinic $BaBiO_3$.** Shen, Z.X.; Lindberg, P.A.P.; Wells, B.O.; Dessau, D.S.; Borg, A.; Lindau, I.; Spicer, W.E.; Ellis, W.P.; Kwei, G.H.; Ott, K.C.; Kang, J.S.; Allen, J.W. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36;AC03-82ER13000. (CONF-891093–8: 36. American Vacuum Society national vacuum symposium, Boston, MA (USA), 23-27 Oct 1989). Order Number DE90002403. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present the results of photoemission studies of "valence disordered" monoclinic $BaBiO_3$ in the photon energy range 15–120 eV. The line-shapes of the valence band photoemission spectra and the Ba contributions to the valence band are very similar to the line

shapes of the total density of states and Ba partial density of states, respectively. Oxygen resonance is observed, demonstrating the existence of empty O 2p states. These results support a more covalent rather than a simple ionic picture for the electronic states of $BaBiO_3$. 10 refs., 2 figs.

1874 (ORNL/FTR–3067) **[Theoretical studies on the electronic structure of high-temperature superconductors].** Shelton, W.A. Jr. Oak Ridge National Lab., TN (USA). 4 Oct 1988. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001301. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report covers a one-year assignment to the University of Bristol to perform work under a sub-contract with the University. While at Bristol, I developed large-scale computer codes for calculating the electronic structure of ordered and disordered high-temperature superconductors. These codes were used to calculate the electronic structure of $Ba_{1-x}K_xBiO_3$ alloys and the Mott insulator NiO.

1875 Gap-modulation infrared spectroscopy of high transition temperature superconductors. Little, W.A. (Stanford Univ., CA (USA)); Collman, J.P. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(13): 4596-4600 (Jul 1988). DOE Contract FG03-86ER45245.

Conventional methods of determining the coupling factor $\alpha^2(\omega)F(\omega)$ for the newly discovered high transition temperature (T_c) cuprate superconductors by using tunneling and infrared measurements have thus far failed to show the cause of the very high T_c of these compounds. This is due in part to difficulties in sample preparation for tunneling studies and to difficulties in obtaining good data at relatively high tunneling voltages. Also, in IR (infrared) measurements, small differences in absorptivity between the normal and superconducting state can be masked by changes in the phonon occupation at high and low temperatures. Here the authors propose a technique for determining the coupling constant, which should be less dependent on the surface quality of the sample than with tunneling and should allow measurements at higher energies with greater precision than do tunneling or simple IR observations. This should make possible a definitive determination of any possible exciton contribution to this coupling term, which would appear at energies well above the range where conventional IR or tunneling measurements are effective.

1876 Nearest-neighbor repulsion in electron-doped high-temperature cuprate superconductors. Fedro, A.J. (Northern Illinois University, DeKalb, Illinois 60115 (US)); Schuttler, H. *Physical Review [Section] B: Condensed Matter (USA),* 40(7): 5155-5157 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

We present results of a strong-coupling expansion of the three-orbital Hubbard model describing motion of holes in the copper system where, in the electron-doped case, the number of holes per Cu site is less than or equal to one. The resulting strong-coupling Hamiltonian is Hubbard-like but with an additional nearest-neighbor repulsion between Cu holes due to the presence of the Cu-O intersite *V* term. We find, using the model parameters estimated by Hybersten *et al.*, that this *repulsive* interaction generated by the *V* term is of the same order as that of the possible spin-fluctuation-mediated *attractive* interaction between Cu sites so that nearest-neighbor quasiparticle pairing is significantly suppressed.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 1741, 1747, 1856, 1858

1877 (AD-A–209822/6/XAB) **Nonlinear waves. Technical report.** Ablowitz, M.J.; Fokas, A.S. Clarkson Coll. of Tech., Potsdam, NY (USA). Dept. of Mathematics. 15 Jun 1989. 9p. Available from NTIS, PC A02/MF A01.

The investigators have been working in the general area of nonlinear wave propagation for over twenty years. The main focus of this work is the understanding of the nonlinear phenomena involved with the wave propagation arising in physical problems. The work has application to numerous areas of physics, engineering, and mathematics. Applications include fluid dynamics, waves in stratified fluids, surface gravity waves, and wave excitation phenomena related to moving pressure distributions; numerical approximation and computation; nonlinear optics; and plasma physics. Moreover, the study of solutions to some of the underlying nonlinear evolution equations has led naturally to the investigation and new results in the separate but closely related field of inverse scattering. Developments to both one and multidimensional inverse problems were made.

1878 (DOE/ER/25009–831) **A new MCRG [Monte Carlo Renormalization Group] calculation of the critical behavior of the 3d Ising model - preliminary results.** Baillie, C.F.; Barish, K.N.; Gupta, R.; Pawley, G.S. California Inst. of Tech., Pasadena, CA (USA). 5 Oct 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-85ER25009;AC03-81ER40050. (CONF-8909249–1: Lattice '89 international workshop, Capri (Italy), Sep 1989). Order Number DE90001426. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have undertaken a large-scale computer simulation of the 3d Ising model using the Monte Carlo Renormalization Group (MCRG) method. Our calculation improves on past calculations in three ways. Firstly, larger lattices are used – we have run on 128^3 as well as 64^3. Secondly, many more spin operators – 53 even and 46 odd – are measured. Lastly, we have incorporated more efficient ways of spin update – Wolff's single-cluster variant of the Swendsen and Wang algorithm. In addition to calculating the critical temperature the thermal and magnetic exponents, and improving the estimate of the correction-to-scaling exponent, we are aiming to verify the presence of redundant operators. We do not yet have sufficient statistics to give final results so here we describe our calculation and present preliminary results which demonstrate that we have control over both finite size effects and systematic errors arising from truncation. 16 refs., 7 figs.

1879 (GSI–89-62(prepr.)) **On a validity of adiabatic approach to the tunneling phenomena.** Drozdz, S.; Kaminski, P.; Ploszajczak, M.; Caurier, E. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Aug 1989. 17p. Available from Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The imaginary time-dependent mean-field approach to the tunneling phenomena is tested in a simple, exactly solvable model. An important role of nonadiabatic effects is found in the region where the approach works well. This is the case of small penetration probability which corresponds to high barriers. Thus, an applicability of the usual cranked mean-field approximation is questionable in this case. (orig.).

1880 (LA-UR–89-3576) **Algorithmic randomness, physical entropy, measurements, and the second law.** Zurek, W.H. Los Alamos National Lab., NM (USA). 1989. 22p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-890875–3: 3. international symposium on foundations of quantum mechanics, Tokyo (Japan), 27-31 Aug 1989). Order Number DE90002413. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Algorithmic information content is equal to the size – in the number of bits – of the shortest program for a universal Turing machine which can reproduce a state of a physical system. In contrast to the statistical Boltzmann-Gibbs-Shannon entropy, which measures ignorance, the algorithmic information content is a measure of the available information. It is defined without a recourse to probabilities and can be regarded as a measure of randomness of a definite microstate. I suggest that the physical entropy S – that is, the quantity which determines the amount of the work ΔW which can be extracted in the cyclic isothermal expansion process through the equation $\Delta W = k_B T \Delta S$ – is a sum of two contributions: the mission information measured by the usual statistical entropy and the known randomness measured by the algorithmic information content. The sum of these two contributions is a "constant of motion" in the process of a dissipation less measurement on an equilibrium ensemble. This conservation under a measurement, which can be traced back to the noiseless coding theorem of Shannon, is necessary to rule out existence of a successful Maxwell's demon. 17 refs., 3 figs.

1881 (UCRL–101302) **Quantum-mechanical approaches to continuum angular distributions.** Mustafa, M.G. Lawrence Livermore National Lab., CA (USA). Jun 1989. 7p. Sponsored by U.S.

DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891103–16: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE89015776. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Starting with the introduction of the exciton model by Griffin in 1966, a series of semiclassical models of varying complexity has been developed for calculating and evaluating particle emissions in the continuum. It was also shown that with some freedom in the choice of parameters, these models can give reasonable fit to the observed energy and angular distributions of the emitted particles. More recently, researchers have formulated several quantum-mechanical reaction theories that are based on multistep concepts and in which statistical evaporation at lower energies is connected to direct reactions at higher energies. The subject of my presentation is these quantum-mechanical theories, with emphasis on their formal differences, calculational complexities, and predictive powers for nucleon-induced reactions below 100 MeV. I will not include the semiclassical theories, since these will be discussed by several speakers at this meeting. 8 refs.

1882 **Calculation of ground states for many-fermion systems.** Nagele, J.W. (Center for Theoretical Physics, Laboratory for Nuclear Science, (US)); Brommer, K.D. *Annals of Physics (New York) (USA),* 192(1): 119-132 (15 May 1989).

A new method is presented for the exact stochastic solution of the ground states of many-Fermion systems. The antisymmetric ground state wavefunction is expressed as the difference between two positive functions, and the non-linear coupled Schrordinger equation for these functions is solved by a generalized path integral Monte Carlo technique. The method is tested on a two-dimensional example, and its applicability to realistic problems is discussed. © 1989 Academic Press, Inc.

70 FUSION ENERGY

1883 (BNL–42852) **Measurements of neutron emission induced by muons stopped in metal deuteride targets.** Chen, M.; Steadman, S.G.; Gaudreau, M.P.J.; Luckhardt, S.C.; Parker, R.R.; Albagli, D.; Cammarata, V.; Schloh, M.; Wrighton, M.S.; Kwok, K.; Thieme, C.; Lowenstein, D.I.; Debbe, R.; Reilly, J.J. Los Alamos National Lab., NM (USA). [1989]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016;AC02-78ET51013. (CONF-8905126–6: Workshop on cold fusion phenomena, Santa Fe, NM (USA), 23-25 May 1989). Order Number DE90001330. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An 80 MeV/c negative muon beam from the Alternating Gradient Synchrotron at Brookhaven National Laboratory was used to investigate the stopping of muons inside Pd, Ti and Y targets saturated with deuterium. Neutron emission from the targets was measured with an array of ^{3}He detectors, and in some runs, the temperature of the target was monitored as a function of time, with and without a flux of muons on the target. The neutron rates were also measured for Pd cathodes in an active electrochemical cell similar in design to those used in so-called "cold-fusion" experiments, and the electrolyte solution was analyzed for excess tritium at rates consistent with these claimed in "cold fusion" experiments. Neutron production catalyzed fusion due to the presence of deuterium in palladium deuteride, $PdD_{0.7}$, exposed to muons was determined in palladium 0.0 ± 0.03 (stat.) ± 0.25 (syst.) neutrons per stored muon. 15 refs., 5 figs.

1884 (EGG-M–89099) **High pressure deuterium-tritium gas target vessels for muon-catalyzed fusion experiments.** Caffrey, A.J.; Spaletta, H.W.; Ware, A.G.; Zabriskie, J.M.; Hardwick, D.A.; Maltrud, H.R.; Paciotti, M.A. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8909204–4: Conference on hydrogen effects on material behavior, Jackson Hole, WY (USA), 12-16 Sep 1989). Order Number DE90002079. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In experimental studies of muon-catalyzed fusion, the density of the hydrogen gas mixture is an important parameter. Catalysis of up to 150 fusions per muon has been observed in deuterium-tritium gas mixtures at liquid hydrogen density; at room temperature, such densities require a target gas pressure of the order of 1000 atmospheres (100 MPa, 15,000 psi). We report here the design considerations for hydrogen gas target vessels for muon-catalyzed fusion experiments that operate at 1000 and 10,000 atmospheres. The 1000 atmosphere high pressure target vessels are fabricated of Type A-286 stainless steel and lined with oxygen-free, high-conductivity (OFHC) copper to provide a barrier to hydrogen permeation of the stainless steel. The 10,000 atmosphere ultrahigh pressure target vessels are made from 18Ni (200 grade) maraging steel and are lined with OFHC copper, again to prevent hydrogen permeation of the steel. In addition to target design features, operating requirements, fabrication procedures, and secondary containment are discussed. 13 refs., 3 figs., 1 tab.

1885 (PPPL–2657) **Some considerations of "cold fusion" including the calculation of fusion rates in molecules of hydrogen isotopes.** Cowley, S.C.; Kulsrud, R.M. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90001822. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We calculate the fusion reaction rates in molecules of hydrogen isotopes. The rates are calculated analytically (for the first time) as an asymptotic expansion in the ratio of the electron mass to the reduced mass of the nuclei. The fusion rates of the P-D, D-D, and D-T reactions are given for a variable electron mass by a simple analytic formula. However, we do not know any mechanism by which a sufficiently localized electron in solid can have an 'effective mass' large enough to explain the result of Fleischman and Pons (FP). This calculation indicates that P-D rates should exceed D-D rates for D-D fusion rates less than approximately 10^{-23} per molecule per second. The D-D fusion rate is enhanced by a factor of 10^5 at 10,000°K if the excited vibrational states are populated with a Boltzmann distribution and the rotational excitations suppressed. The suggestion that experimental results could be explained by bombardment of cold deuterons by kilovolt deuterons is shown to be an unlikely from an energetic point of view. 12 refs., 3 figs., 1 tab.

1886 **Hot fusion, cold fusion.** Sayer, B. (CEA, 75 - Paris (FR)). *Revue de l'Energie (France),* 40(412): 495-497 (Jun-Jul 1989). (In French).

The publication of observations of nuclear fusion reactions in electrolysis experiments has led to hope that an easy way to domesticate this major source of energy had been found. In this article are recalled the classical solutions which are studied for hot fusion, the state of the art the difficulties and the perspectives, followed by the present situation concerning the experiments related to what has been called, perhaps a little too quickly, cold fusion.

7001 Plasma Research

Refer also to citation(s) 334, 631, 1036, 1103, 1561, 1636, 1646, 1649, 1660, 1669, 1682, 1697, 1921, 1924, 1926, 1973, 1976

1887 (AD-A–206915/1/XAB) **Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989.** Cox, L.T. Air Force Astronautics Lab., Edwards AFB, CA (USA). Mar 1989. 35p. (AFAL-TR–89-006). Available from NTIS, PC A03/MF A01.

The feasibility fusion-powered propulsion is being explored. This report builds on a bibliography of all known thermonuclear reactions involving reactant particles up to and including (Boron-11). However, in the report, the neutron-induced reactions have been eliminated. A few reactions new to the earlier report have been found and are included. This report will form the basis for future reports generated from this study. In these future reports, fuel cycles, reaction rates, nuclear scattering, and ignition temperatures will be addressed. Included in this interim report are cross section data for four of the more attractive, in terms of safety, reactions. Graphs showing the data are also presented herein, including one which compares the cross section data curves of the four reactions. All of the data sets are analyzed and recommendations for future cross section work are made.

1888 (CONF-891007–22) **MHD equilibrium and stability considerations for high-aspect-ratio ARIES-I tokamak reactors.** Peng, Y.K.M.; Strickler, D.J.; Hogan, J.T.; Whitson, J.C.; Bathke, C.G.; Evans, K. Jr.; Jardin, S.C.; Klasky, M.; Leuer, J.A. Oak Ridge National Lab., TN (USA). 1989. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002152. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The requirements of an external poloidal field coil (PFC) system with minimum stored energy, double-null divertor plasmas with elongated D shape, adequate passive stabilization of plasma vertical displacement by a vacuum vessel located behind the blanket zone, and an enhanced plasma beta limit in the first stability regime are incorporated in the ARIES-I concept for a high-field tokamak reactor with high aspect ratio (A = 4.5). The plasma current and pressure profiles are also made consistent with enhanced bootstrap current I_{bs} and reduced current drive power by means of ion cyclotron wave (ICW) or neutral beam (NB) injection. These lead to plasmas characterized by an elongation k_x of 1.8 to the divertor X-point, a triangularity δ_x of 0.7, a safety factor q on axis of $q_0 \approx 1.5$, a safety factor at the edge $q_{95} > 4$, a plasma beta $\beta \approx 2\%$, and a poloidal beta given by $\epsilon\beta_p \approx 0.5$ ($\epsilon = 1/A$). With a plasma current I_p of 11 MA, a toroidal field B_t of 13 T at the major radius R_0 of 6.5 m, and over 3.5 m of clearance between the PFCs and the plasma edge, the stored energy in the PFC system ranges from 20 GJ during plasma operation at low beta to 12 GJ during plasma operation at high beta. 16 refs., 6 figs., 2 tabs.

1889 (CONF-891007–24) **Studies of plasma performance and transport in the advanced toroidal facility (ATF).** Neilson, G.H.; Bigelow, T.S.; Carreras, B.A.; Colchin, R.J.; Crume, E.C.; Dunlap, J.L.; Dyer, G.R.; England, A.C.; Glowienka, J.C.; Halliwell, J.W.; Harris, J.H.; Hedrick, C.L.; Hillis, D.L.; Hiroe, S.; Horton, L.D.; Howe, H.C.; Isler, R.C.; Jernigan, T.C.Oak Ridge National Lab., TN (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90001737. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An overview of recent ATF experimental results and program plans is presented, with emphasis on the role of magnetic configuration controls in transport studies. The ATF operating space is bounded by a density limit that effectively sets a limit on the energy confinement time τ_E. Although this limit is not solely due to impurities, it has recently been raised by improved cleanliness following titanium gettering. This has led to collapse-free neutral beam injection (NBI) discharges with global $\tau_E \approx 16$ ms. Preliminary experiments show that stored energy and bootstrap current are sensitive to details of the magnetic configuration. 13 refs., 8 figs.

1890 (CONF-8909238–1) **TF-ripple loss of suprathermal alphas in ITER: Progress report.** Oak Ridge National Lab., TN (USA). 30 Sep 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From ITER technical committee meeting; Garching (Germany, F.R.); 27 Sep 1989. Order Number DE90001346. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

TF-ripple loss of alphas below the critical energy is calculated for a noncircular ITER plasma. For 14 toroidal field (TF) coils, the particle loss was found to be about 6%. About 0.6% of the initial alpha energy (3.5 MeV) is lost. 26 refs., 9 figs., 3 tabs.

1891 (DOE/ER/53212–144) **Theoretical reversed field pinch studies: Annual progress report, October 31, 1988–November 1, 1989.** Wisconsin Univ., Madison, WI (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53212. Order Number DE90002114. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: Nonlinear behavior of the RFP with non-ideal boundary conditions; Field error effects on 3-D equilibria; and Hall effects. (LSP)

1892 (DOE/ER/53242–3) **Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-Wave heating: Progress report No. 3, July 16, 1988–July 15, 1989.** Ribe, F.L.; Nelson, B.A. Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program. 1989. 61p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER53242. (UWAERP–20). Order Number DE90001704. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: Nonaxisymmetric radio- frequency heating in an l = 1 stellarator and in a linear plasma column; measurement of induced current in a hardcore theta pinch; externally driven tilt mode study on an FRC; elimination of induced plasma current in a hardcore theta pinch; and simulated toroidicity studies.

1893 (DOE/ER/53266–16) **Transport modeling and advanced computer techniques.** Wiley, J.C.; Ross, D.W.; Miner, W.H. Jr. Texas Univ., Austin, TX (USA). Fusion Research Center. Nov 1988. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER53266. (FRCR–321). Order Number DE90001481. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A workshop was held at the University of Texas in June 1988 to consider the current state of transport codes and whether improved user interfaces would make the codes more usable and accessible to the fusion community. Also considered was the possibility that a software standard could be devised to ease the exchange of routines between groups. It was noted that two of the major obstacles to exchanging routines now are the variety of geometrical representation and choices of units. While the workshop formulated no standards, it was generally agreed that good software engineering would aid in the exchange of routines, and that a continued exchange of ideas between groups would be worthwhile. It seems that before we begin to discuss software standards we should review the current state of computer technology — both hardware and software to see what influence recent advances might have on our software goals. This is done in this paper.

1894 (GSI–89-21) **High energy density in matter produced by heavy ion beams. Annual report.** Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Jul 1989. 74p. Order Number DE90718236. Available from NTIS (US Sales Only), PC A04/MF A01.

This Annual Report summarizes research activities carried out in 1988 in the framework of the government-funded program 'High Energy Density in Matter produced by Heavy Ion Beams'. It addresses fundamental problems of the generation of heavy ion beams and the investigation of hot dense plasmas produced by these beams. Its initial motivation and its long-term goal is the feasibility of inertial confinement fusion by intense heavy ion beams. Two outstanding events deserve to be mentioned explicity, the Heavy Ion Inertial Fusion Conference held in Darmstadt and organized by GSI end of June and the first heavy ion beam injected into the new SIS facility in November. The former event attracted more than hundred scientists for three days to the 4th Conference in this field. This symposium showed the impressive progress since the last conference in Washington two years ago. In particular the first beams in MBE-4 at LBL and results of beam plasma interaction experiments at GSI open new directions for future investigations. The ideas for non-Lionvillean injection into storage rings presented by Carlo Rubbia will bring the discussion of driver scenarios into a new stage. The latter event is a milestone for both machine and target experiments. It characterizes the beginning of the commissioning phase for the new SIS/ESR facility which will be ready for experiments at the end of this year. The commissioning of SIS is on schedule and first experiments can start at the beginning of 1990. A status report of the accelerator project is included. Theoretical activities were continued as in previous years, many of them providing guide lines for future experiments, in particular for the radiation transport aspects and for beam-plasma interaction. (orig.).

1895 (GSI–89-24) **Studies on the production of high energy densities in matter by intense heavy-ion beams.** Jacoby, J. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Heidelberg Univ. (Germany, F.R.). Aug 1989. 95p. (In German). Order Number DE90718235. Available from NTIS (US Sales Only), PC A05/MF A01.

In the framework of the present thesis the interaction of an intense heavy-ion beam with a small, but macroscopical amount of

matter is studied. Thereby high energy densities in the target matter are produced. For this experiment it was for the first time possible to heat matter with ion beams from conventional heavy-ion accelerators up to plasma conditions. A KR^+-ion beam was first accelerated with the heavy-ion accelerator MAXILAC to 45 keV/u and then focussed by a fine-focusing lens to a closed xenon gas target. The light emitted from the target was space- and time resolved taken up by a spectrometer as well as by a streak and CCD camera. Thereby the radial development of the plasma and the penetration behaviour of the ion beam was observed. The free electron density of the plasma was determined from the Stark broadening of emission lines ($n_e \simeq 4x10^{16}$ cm^{-3}). The temperature could be determined by different methods (shock-wave velocity, degree of ionization, line ratios). The electron temperature amounted in the center of the pipe to $kT \simeq 0.75$ eV. For the opacity of the target by which the emitted light power is determined under the assumption of the two-dimensional model (equilibrium between emitted and absorbed energy) the value $\kappa_p \simeq 7700$ cm^2/g resulted. (orig./HSI).

1896 (INIS-BR–1624, pp. 20-21) **Perspectives of electron-capture and alternative methods for dianosis of particle sources and acceleration processes.** Perez-Peraza, J. (Universidad Autonoma Metropolitana, Mexico City. Inst. de Geofisica). Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. COSMIC RAY PROPAGATION/bench-scale experiments; COSMIC RAY PROPAGATION/particle sources; PLASMA DIAGNOSTICS/bench-scale experiments; PLASMA DIAGNOSTICS/cosmic ray propagation; PLASMA DIAGNOSTICS/particle sources; ACCELERATION; ELECTROMAGNETIC FIELDS; ELECTROMAGNETIC INTERACTIONS; ELECTRON CAPTURE

1897 (INIS-BR–1624, pp. 73) **Ionospheric electron temperature rocket measurements with langmuir probe over Natal, Brazil, in 1985.** Kantor, I.J.; Muralikrishna, P.; Abdu, M.A. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. E REGION/electron temperature; E REGION/langmuir probe; F REGION/electron temperature; F REGION/langmuir probe; BRAZIL; KINETICS; ROCKETS; TEMPERATURE MEASUREMENT

1898 (INIS-BR–1624, pp. 74) **Complex rocket - satellite experiment with plasma injection in magnetic anomaly region.** Korobeinikov, V.G. (Izmiran, USSR, Moscow); Oraevsky, V.N.; Ruzhin, Yu.Ya.; Skomarovsky, V.S.; Techimirev, V.M.; Namazov, C.A.; Pokhunkov, A.A.; Nesmeynov, V.I. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. IONOSPHERE/magnetic storms; IONOSPHERE/plasma diagnostics; IONOSPHERE/plasma jets; DYNAMICS; IONOSPHERE; PLASMA WAVES; ROCKETS

1899 (INIS-BR–1624, pp. 117) **Ion-ion acoustic waves versus electron-ion acoustic waves.** Gomberoff, L. (Chile Univ., Santiago (Chile). Dept. de Fisica); Vega, P. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. EARTH MAGNETOSPHERE/magnetotail; ION WAVE INSTABILITY/earth magnetosphere; BEAM-PLASMA SYSTEMS; MAGNETOTAIL; ION ACOUSTIC WAVES; ION BEAMS; WAVE PROPAGATION

1900 (INIS-BR–1624, pp. 128) **Absolute stability in a low density electron heat conducting plasma in strong magnetic fields.** Torre, A. de la; Duhan, S. Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil). 1988. (CONF-8811276–: 1. Latin-American conference on space geophysics, Aguas de Lindoia (Brazil), 21-25 Nov 1988). In *Proceedings of the 1. Latin-American Conference on Space Geophysics.* Order Number DE90606044. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRONS/heat flux; ELECTRONS/magnetic fields; ELECTRONS/plasma; MAGNETOACOUSTIC WAVES/plasma; ANISOTROPY; DISPERSION RELATIONS; ELECTRONS; PLASMA; HYDRODYNAMICS

1901 (LA-UR–89-3327) **Vertical stability requirements for ARIES-I reactor.** Bathke, C.G.; Jardin, S.C.; Leuer, J.A.; Ward, D.J. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–65: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002441. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The vertical stability of the ARIES-I reactor design is analyzed with the NOVA-W, PSTAB, and TSC codes. A growth rate of ~5.7 s^{-1} is predicted for a vacuum vessel positioned behind the scrape-off, first wall, and blanket (0.7 in inboard and 0.9 in outboard thickness) and acting as a passive stabilizer. A reactive power of ~2 MV A would be required for active feedback coils located outside of the TF coils ~3 m to correct a 50-mm vertical displacement of the magnetic axis. A multipolar expansion technique used in the TSC analysis is also used to examine options that minimize stored energy. 10 refs., 8 figs., 2 tabs.

1902 (N–89-26720) **Plasma diagnostics package. Volume 2: Spacelab 2 section. Part B: Thesis projects. Final science report.** Pickett, J.S.; Frank, L.A.; Kurth, W.S. Iowa Univ., Iowa City, IA (USA). Jun 1988. 725p. (NASA-CR–183699;NAS–1.26:183699). Available from NTIS, PC A99/MF E03.

This volume (2), which consists of two parts (A and B), of the Plasma Diagnostics Package (PDP) Final Science Report contains a summary of all of the data reduction and scientific analyses which were performed using PDP data obtained on STS-51F as a part of the Spacelab 2 (SL-2) payload. This work was performed during the period of launch, July 29, 1985, through June 30, 1988. During this period the primary data reduction effort consisted of processing summary plots of the data received by 12 of the 14 instruments located on the PDP and submitting these data to the National Space Science Data Center (NSSDC). Three Master's and three Ph.D. theses were written using PDP instrumentation data. These theses are listed in Volume 2, Part B.

1903 (N–89-26721) **Plasma diagnostics package. Volume 1: OSS-1 section. Final science report.** Pickett, J.S.; Frank, L.A.; Kurth, W.S. Iowa Univ., Iowa City, IA (USA). Jun 1988. 234p. (NASA-CR–183697;NAS–1.26:183697). Available from NTIS, PC A11/MF A01.

This volume (1) of the Plasma Diagnostics Package (PDP) final science report contains a summary of all of the data reduction and scientific analyses which were performed using PDP data obtained on STS-3 as a part of the Office of Space Science first payload (OSS-1). This work was performed during the period of launch, March 22, 1982, through June 30, 1983. During this period the primary data reduction effort consisted of processing summary plots of the data received by the 14 instruments located on the PDP and submitting these data to the National Space Science Data Center (NSSDC). The scientific analyses during the performance period consisted of general studies which incorporated the results of several of the PDP's instruments, detailed studies which concentrated on data from only one or two of the instruments, and joint studies of beam-plasma interactions with the OSS-1 Fast Pulse Electron Generator (FPEG) of the Vehicle Charging and Potential Investigation (VCAP). Internal reports, published papers and oral presentations which involve PDP/OSS-1 data are listed in Sections 3 and 4. A

PDP/OSS-1 scientific results meeting was held at the University of Iowa on April 19-20, 1983. This meeting was attended by most of the PDP and VCAP investigators and provided a forum for discussing and comparing the various results, particularly with regard to the shuttle orbiter environment. One of the most important functional objectives of the PDP on OSS-1 was to characterize the orbiter environment.

1904 (N–89-26722) **Plasma diagnostics package. Volume 2: Spacelab 2 section, part A. Final science report.** Pickett, J.S.; Frank, L.A.; Kurth, W.S. Iowa Univ., Iowa City, IA (USA). Jun 1988. 488p. (NASA-CR–183698;NAS–1.26:183698). Available from NTIS, PC A21/MF A01.

This volume (2), which consists of two parts (A and B), of the Plasma Diagnostics Package (PDP) Final Science Report contains a summary of all of the data reduction and scientific analyses which were performed using PDP data obtained on STS-51F as a part of the Spacelab 2 (SL-2) payload. This work was performed during the period of launch, July 29, 1985, through June 30, 1988. During this period the primary data reduction effort consisted of processing summary plots of the data received by 12 of the 14 instruments located on the PDP and submitting these data to the National Space Science Data Center (NSSDC). The scientific analyses during the performance period consisted of follow-up studies of shuttle orbiter environment and orbiter/ionosphere interactions and various plasma particle and wave studies which dealt with data taken when the PDP was on the Remote Manipulator System (RMS) arm and when the PDP was in free flight. Of particular interest during the RMS operations and free flight were the orbiter wake studies and joint studies of beam/plasma interactions with the SL-2 Fast Pulse Electron Generator (FPEG) of the Vehicle Charging and Potential Investigation (VCAP). Internal reports, published papers and presentations which involve PDP/SL-2 data are listed in Sections 3 and 4. A PDP/SL-2 scientific results meeting was held at the University of Iowa on June 10, 1986. This meeting was attended by most of the PDP and VCAP investigators and provided a forum for discussing and comparing the various results, particularly with regard to the PDP free flight.

1905 (PB–89-859995/XAB) **Optical-phase conjugation. January 1979-March 1989 (Citations from the Compendex data base). Report for January 1979-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 109p. Available from NTISPC N01/MF N01.

Supersedes PB–88-861877.

This bibliography contains citations concerning media and surfaces to produce an optical phase-conjugate wave. The phase-conjugate mirrors can be liquid, compressed gas, glass, or crystal. Phase conjugation, producing an ideal light beam by reversing the beam and passing it through a medium which on the first pass produced distortions, has recently moved from the laboratory and is now being used for practical applications. Some applications include holography, high-energy laser beams for plasma diagnostics, and laser heating of plasmas. The citations include stimulated Brillouin scattering and four-wave mixing as methods for phase conjugation. (This updated bibliography contains 271 citations, 113 of which are new entries to the previous edition.)

1906 (PFC/JA–89-37) **Kinetic ray tracing in toroidal geometry with application to mode-converted ion-Bernstein waves.** Ram, A.K.; Bers, A. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (CONF-891182–2: International conference on plasma physics, New Delhi (India), 22-28 Nov 1989). Order Number DE90001829. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We discuss results of detailed numerical and analytical studies on the propagation of ion-Bernstein waves (IBW) in a toroidal plasma. Such waves can be excited by mode conversion of an externally launched fast Alfven wave near the ion-ion hybrid resonance (or near the second harmonic resonance for a single ion species plasma) in a tokamak. We find that there is a significant upshift in the poloidal mode numbers of the IBW over short radial distances of propagation so that the IBW can Landau damp onto the electrons. The numerically obtained results are corroborated by a simple analytical model. 4 refs., 4 figs.

1907 (UCRL–100498) **Absolute multilayer characterization at high spatial resolution via real-time soft x-ray imaging.** Madison, L. Lawrence Livermore National Lab., CA (USA). Aug 1989. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890836–17: 33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering, San Diego, CA (USA), 6-11 Aug 1989). Order Number DE90002314. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An imaging-based technique has been modeled for its suitability and performance in measuring the spatial distribution of the absolute soft x-ray characterization of flat multilayer mirrors. Such a technique, if implemented experimentally, is anticipated to have substantially higher throughput (wafers/day) than is possible from prevailing non-imaging means. 5 figs.

1908 (UCRL–101947) **Operating point selection and burn stability control for the International Thermonuclear Experimental Reactor.** Haney, S.W.; Perkins, L.J. Lawrence Livermore National Lab., CA (USA). 26 Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-891007–43: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002219. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The selection and burn stability control of near-ignited operating points for the International Thermonuclear Experimental Reactor (ITER) are considered. It is suggested that high density ($<T_e>_n \sim$ 6-10 keV) operating points are preferred from considerations of proximity to magnetohydrodynamic (MHD) stability limits, divertor operation, and fueling even though those points are intrinsically thermally unstable. Results from simple 0-D transport simulations suggest that these operating points can be effectively stabilized at $Q > 50$ if neutral beam feedback based on total neutron flux measurements is employed. 10 refs., 4 figs.

1909 **Self-focusing of laser beams in magnetized relativistic electron beams.** Whang, M.H. (Polytechnic Univ., Farmingdale, NY (US)); Kuo, S.P.; Ho, A.Y. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper JK3.

The authors study the problem concerning the self-focusing of the laser beam in the relativistic electron beams under the cyclotron autoresonance interaction. They assume that there is no electron density perturbation prohibited from the background magnetic field for the time scale of interest. The nonlinearity responsible for the self-focusing process is introduced by the energy dependence of the relativistic mass of electrons.

1910 **Spatially nonuniform traveling waves bifurcating from single-humped Vlasov equilibria.** Holloway, J.P.; Dorning, J.J. *Transactions of the American Nuclear Society (USA),* 57: 100-102 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The results summarized here for traveling wave solutions near single-humped Vlasov equilibria, combined with those we recently have reported for traveling wave solutions nearby multihumped Vlasov equilibria comprise a nonlinear theory of undamped longitudinal plasma waves, which (a) shows that there exist small-amplitude perturbations of single-humped Vlasov equilibria (predicted to damp by linear analysis) that in fact do not damp, and (b) provides nonlinear wave solutions that are likely candidates for the saturated states of unstable multihumped (e.g., bump-on-the-tail) Vlasov equilibria.

1911 **CFRX, a one-and-a-quarter-dimensional transport code for field-reversed configuration studies.** Hsiao Mingyuan (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering); Werley, K.A.; Ling, K.M. *Computer Physics Communications (Netherlands),* 54(2/3): 329-352 (Jun-Jul 1989).

Cray 1, Cray-XMP; Fortran.

A one-and-a-quarter-dimensional transport code, which includes radial as well as some two-dimensional effects for field-reversed

configurations, is described. The set of transport equations is transformed to a set of new independent and dependent variables and is solved as a coupled initial-boundary value problem. The code simulation includes both the closed and open field regions. The axial effects incorporated include global axial force balance, axial losses in the open field region, and flux surface averaging over the closed field region. A typical example of the code results is also given. (orig.).

1912 **Status of magnetic fusion.** Clarke, J.F. (Dept. of Energy, Washington, DC (USA)). *Journal of Fusion Energy (USA),* 6(4): 391-399 (Dec 1987). (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

The technological, political, and economic status of magnetic fusion research in the United States is discussed. Governmental and political scenarios for the development of magnetic fusion are assessed. A range of research is reviewed, including such programs as the Compact Ignition Tokamak, the Jet, TFTR, and JT-60 tokamaks, the DIII-D reactor, laser fusion reactors, and the Tritium Systems Test Facility. Management organization requirements and structures are developed and evaluated for overall reactor research and development planning. Busgetary constraints and opportunities for magnetic fusion are evaluated. The technical aspects include heating and diagnostics strategies.

1913 **DIII-D power supply fault system.** VanderLaan, J.F. (General Atomics Co., San Diego, CA (USA)); Smith, T.L. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1746-1748 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The DIII-D tokamak magnetic confinement fusion device at General Atomics has been equipped with a power supply fault system which provides orderly shutdown in case of any of a number of faults. The nature of the fault dictates the extent of the shutdown required. CAMAC hardware accumulates data and triggers computer acquisition of diagnostic information. The system speeds diagnosis and repair of problems.

1914 **Development of a Li^- ion source.** Walther, S.R. (Accelerator and Fusion Research Division, Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, California 94720 (US)); Morse, E.C.; Leung, K.N. *Journal of Applied Physics (USA),* 66(7): 2930-2939 (1 Oct 1989). DOE Contract AC03-76SF00098.

Sources of Li^- ions are needed for diagnostic neutral beams for fusion research. Previous efforts to generate Li^- beams have focused on electron capture in a gas or production on a low work-function surface in a plasma. Volume production of Li^- by dissociative attachment of optically pumped lithium molecules has also been studied. This paper presents experimental results for volume production of a Li^- ion beam from a plasma discharge. These results show that a discharge source of Li^- ions can provide suitable current densities for diagnostic beams. A theoretical model for the formation of Li^- ions from Li_2 molecules in the lithium discharge is developed. The model is in good agreement with the experimental results and shows favorable parameter scalings for further improvement of the Li^- ion source.

1915 **Super-transition-arrays: A model for the spectral analysis of hot, dense plasma.** Bar-Shalom, A. (Nuclear Research Center-Negev, P.O. Box 9001, Beer Sheva 84190, Israel (IL)); Oreg, J.; Goldstein, W.H.; Shvarts, D.; Zigler, A. *Physical Review [Section] A: General Physics (USA),* 40(6): 3183-3193 (15 Sep 1989).

A method is presented for calculating the bound-bound emission from a local thermodynamic equilibrium plasma. The total transition array of a specific single-electron transition, including all possible contributing configurations, is described by only a small number of super-transition-arrays (STA's). Exact analytic expressions are given for the first few moments of an STA. The method is shown to interpolate smoothly between the average-atom (AA) results and the detailed configuration accounting that underlies the unresolved transition array (UTA) method. Each STA is calculated in its own, optimized potential, and the model achieves rapid convergence in the number of STA's included. Comparisons of predicted STA spectra with the results of the AA and UTA methods are presented. It is shown that under certain plasma conditions the contributions of low-probability transitions can accumulate into an important component of the emission. In these cases, detailed configuration accounting is impractical. On the other hand, the detailed structure of the spectrum under such conditions is not described by the AA method. The application of the STA method to laser-produced plasma experiments is discussed.

1916 **X-ray emission caused by Raman scattering in long-scale-length plasmas.** Drake, R.P. (Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Turner, R.E.; Lasinski, B.F.; Williams, E.A.; Estabrook, K.; Kruer, W.L.; Campbell, E.M.; Johnston, T.W. *Physical Review [Section] A: General Physics (USA),* 40(6): 3219-3225 (15 Sep 1989). DOE Contract W-7405-ENG-48.

By analysis of data from a specific set of laser-plasma interaction experiments, it is argued that stimulated Raman scattering (SRS) is responsible for the hard (>30-keV) x rays emitted from the targets. The Novette laser [K. R. Manes *et al.*, Laser Part. Beams 3, 173 (1985)] was used to irradiate thick, gold targets with up to 4 kJ of 0.53-μm light in 1-ns, Gaussian pulses at average intensities of $(1–200)\times10^{14}$ W/cm^2, producing approximately planar plasmas with temperatures of order 3 keV and density-gradient scale lengths of order 250 μm. The spectrum, amplitude, and timing of the hard x rays emitted by the plasma were measured along with various properties of the scattered light. All the data are consistent with the hypothesis that SRS is the source of the hot electrons that emit the x rays, and some data conflict with any other plausible hypothesis.

1917 **Self-focusing of an optical beam in a plasma.** Kurki-Suonio, T. (Department of Physics and Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712 (US)); Morrison, P.J.; Tajima, T. *Physical Review [Section] A: General Physics (USA),* 40(6): 3230-3239 (15 Sep 1989).

Self-focusing of an intense optical beam in a plasma is studied, including the nonlinear effects of both the relativistic electron mass and the ponderomotive potential due to the electromagnetic wave. An exact steady-state asymptotic solution of beam propagation in a localized solitary waveform is obtained in slab geometry. Amplitude-width scaling relations are obtained, which imply that the width is limited to be less than the square root of three collisionless skin depths. In the weakly relativistic limit our solution reduces to the solution obtained by Schmidt and Horton [Comm. Plasma Phys. Controlled Fusion E 9, 85 (1985)]. Solutions where the beam profile is of oscillatory nature, which correspond to the presence of the steady-state solution of a multiple-beamlet profile, are also presented. Finally, the asymptotic nature of the solitary wave is tested using a recently developed numerical particle simulation code.

7002 Fusion Power Plant Technology

Refer also to citation(s) 334, 395, 470, 1013, 1037, 1038, 1913

1918 (CONF-890982–4) **A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium.** Meadows, J.W.; Smith, D.L.; Greenwood, L.R; Haight, R.C.; Ikeda, Y.; Konno, C. Argonne National Lab., IL (USA). 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38;W-7405-ENG-36. 5064/CF. From International meeting on neutron activation cross section for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989. Order Number DE90001437. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Identical sample packets, each containing samples of elemental copper, silver, europium, terbium, and hafnium, as well as titanium, iron and nickel as dosimeters, have been irradiated in three distinct accelerator neutron fields as part of an interlaboratory research collaboration to search for the production of long-lived radionuclides for fusion waste disposal applications. This paper is a progress report on this project. To date, we have detected the following activities, and have obtained preliminary experimental cross section values for several of these: Ag-106m,108m,110m; Eu-150m,152g,154; Tb-158,160; and Hf-175,178m2,179m2,181. 11 refs., 1 fig., 4 tabs.

1919 (CONF-891007–73) **The CIT [compact ignition tokamak] pellet injection system: Description and supporting research and development.** Gouge, M.J.; Combs, S.K.; Fisher, P.W.; Milora, S.L. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002471. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Compact Ignition Tokamak (CIT) will use an advance, high-velocity pellet injection system to achieve and maintain ignited plasmas. Two pellet injectors are provided: a moderate-velocity (1- to 1.5-km/s), single-stage pneumatic injector with high reliability and a high-velocity (4- to 5-km/s), two-stage pellet injector that uses frozen hydrogenic pellets encased in sabots. Both pellet injectors are qualified for operation with tritium feed gas. Issues such as performance, neutron activation of injector components, maintenance, design of the pellet injection vacuum line, gas loads to the reprocessing system, and equipment layout are discussed. Results and plans for supporting research and development (R and D) in the areas of tritium pellet fabrication and high-velocity, repetitive two-stage pneumatic injectors are presented. 7 refs., 4 figs., 2 tabs.

1920 (CONF-891103–24) **Microstructural evolution of martensitic steels during fast neutron irradiation.** Maziasz, P.J. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE89016231. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Irradiation of martensitic/ferritic steels with fast neutrons ($E > 0.1$ MeV) to displacement damage levels of 30–50 dpa at temperatures of 300–500°C produces significant changes in the as-tempered microstructure. Dislocation loops and networks can be produced, irradiation-induced precipitates can form, the lath/subgrain boundary structure and the thermal precipitates produced during tempering can become unstable, and if helium is present, bubbles and voids can form. These microstructural changes caused by irradiation can have important effects on the properties of this class of steels for both fast breeder reactor (FBR) and magnetic fusion reactor (MFR) applications. The purpose of this paper is to compare reactor-irradiated and long-term thermally aged 9Cr–1MoVNb specimens, in order to distinguish effects due to displacement damage from those caused by elevated-temperature exposure alone. 7 refs., 1 fig.

1921 (CONF-8905224–1) **Control of helium accumulation by fishbones.** Varadarajan, V.; Miley, G.H. Illinois Univ., Urbana, IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. From ITER impurity control workshop; Princeton, NJ (USA); May 1989. Order Number DE90001566. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

It is well known that fishbone oscillations occur in the tokamak plasma at high $\epsilon\beta p$ and in the presence of large hot trapped particle population. We adopt and extend the formalism of Chen et al. to analyze the trapped hot ion induced fishbones in the ITER-type plasma. Using the familiar assumptions like large assumptions like large aspect ratio and low beta, we considered the stability of the trapped-ion induced internal kink mode in the presence of alphas and one other species of hot ions.

1922 (CONF-8909234–1) **Measurement of long-lived isotopes and helium production in fusion materials.** Greenwood, L.R. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Advisory group meeting on nuclear data for radiation damage assessment and related safety aspects; Vienna (Austria); 19-22 Sep 1989. Order Number DE90001443. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results are summarized for measurements of the production rates for long-lived radioisotopes and helium in fusion reactor materials. Measurements have been performed at T(d,n) generators, near 14 MeV; at broad-spectrum Be(d,n) accelerator-based neutron fields; and in various fission reactors. These activation data are used to predict the production of these isotopes in fusion reactor materials for the simulation of fusion materials damage in fission reactor irradiations and as a stable product dosimeter. Nuclear data needs and future plans are discussed. 20 refs., 5 figs., 4 tabs.

1923 (CONF-8910225–2) **Determination of ICRF antenna fields in the vicinity of a 3-D Faraday shield structure.** Ryan, P.M.; Rothe, K.E.; Whealton, J.H.; Shepard, T.D. Oak Ridge National Lab., TN (USA). [1989]. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on ICRH/edge physics; Munich (Germany, F.R.); 2-5 Oct 1989. Order Number DE90001354. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A three-dimensional (3-D) magnetostatic analysis developed at Oak Ridge National Laboratory has been used to calculate the electromagnetic transmission properties of representative Faraday shield designs. The analysis uses the long-wavelength approximation to obtain a 3-D Laplace solution for the magnetic scalar potential over one poloidal period of the Faraday shield, from which the complete magnetic field distribution may be obtained. Once the magnetic field distributions in the presence and absence of a Faraday shield are known, the flux transmission coefficient can be found, as well as any change in the distributed inductance of the current strap. The disturbed capacitance of the strap can be found from an analogous 3-D electrostatic calculation, enabling the phase velocity of the slow-wave structure to be determined. Power dissipation in the shield may be estimated by equating the surface current on a perfect conductor with the surface magnetic field and using the surface current in conjunction with the finite conductivities of the shield materials to obtain the power distribution to eddy current heating. 4 refs., 5 figs., 1 tab.

1924 (CONF-8910225–3) **ICRF Faraday shield plasma sheath models: Low and high conductivity limits.** Whealton, J.H.; Ryan, P.M.; Raridon, R.J. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on ICRH/edge physics; Munich (Germany, F.R.); 2-5 Oct 1989. Order Number DE90001757. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Using a 2-D nonlinear formulation which explicitly considers the plasma edge near a Faraday shield in a self consistent manner, progress is indicated in the modeling of the ion motion for a Faraday shield concept and model suggested by Perkins. Several models are considered which may provide significant insight into the impurities generation for ICRH antennas. 6 refs., 8 figs.

1925 (CONF-8910225–4) **Experimental evidence of increased electron temperature, plasma potential, and ion energy near an ICRF antenna Faraday shield.** Caughman, J.B.O. II; Ruzic, D.N.; Hoffman, D.J. Oak Ridge National Lab., TN (USA). 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on ICRH/edge physics; Munich (Germany, F.R.); 2-5 Oct 1989. Order Number DE90001959. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Plasma properties and ion energies have been measured near the surface of the Faraday shield for an ICRF antenna to determine the effect of rf fields on the energy of ions bombarding the shield surface. A resonant loop antenna with a two-tier Faraday shield was used on the rf Test Facility at Oak Ridge National Laboratory. The ECH plasma was produced by a 10.6 GHz klystron and had a central density of $\sim 10^{11}$ cm^{-3} and an electron temperature of 5–10 eV. The static magnetic field at the antenna was ~2 kG. A capacitive probe was used to measure the time-varying floating potential and a Langmuir probe was used to measure the time-averaged electron temperature, density, and dc floating potential. Both probes were scanned in front of the antenna. Ion energies were measured with a gridded energy analyzer located next to the antenna. The time-varying floating potential followed the magnetic field pattern of the antenna, indicating that the electromagnetic field is responsible for the potential formation. Potential values of 300 V p-p have been measured. Electron temperatures increased with rf power and reached values $\geq$ 60 eV for an rf power of ~25 kW. The energy of ions hitting a grounded surface also increased with rf power and exceeded 300 eV at ~25 kW of rf power (compared with energies of 5–15 eV with no rf power). The increase in ion energy can be at

least partially explained by an increase in the sheath potential, which in turn is caused by an increase in the electron temperature. 9 refs., 4 figs.

1926 (CONF-8910225–5) **Electron heating and static sheath enhancement in front of energized rf antennas.** Carter, M.D.; Batchelor, D.B.; Jaeger, E.F. Oak Ridge National Lab., TN (USA). [1989]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on ICRF/edge physics; Munich (Germany, F.R.); 2-5 Oct 1989. Order Number DE90001334. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An analytic model has been developed to describe the increased plasma potential and acceleration of ions in the vicinity of an ICRF Faraday shield. This model gives an estimate for the electron distribution function using a heating model with decorrelation caused by reflection of the electrons from the static sheath at the point where a magnetic field line intersects a grounded wall. The loss rate of the electrons from the system can be calculated from this distribution function. The expected static potential is then estimated by equating electron and ion loss rates, assuming either that the ion loss satisfies the Bohm sheath criterion or that ion gyro-orbits strike a nearby wall. The analytic model for the electrons is in good agreement with a Monte Carlo model using realistic values of the rf electric fields. These rf near-field values have been calculated, including the linear near-field plasma response and the Faraday shield. Results include the findings that a linear model for the rf plasma response is valid for typical experimental parameters and that plasma currents must be included in the rf near-field calculation. It is also found that the static potential is sufficiently increased by electron heating so that it could easily cause impurities to be generated from the antenna structure. Results of the expected static potential are given for various ion species. 9 refs., 4 figs.

1927 (DOE/DP/10560–6) **Inertial fusion research: 1988 Annual technical report, October 1987–September 1988.** Larsen, J.T. (ed.). KMS Fusion, Inc., Ann Arbor, MI (USA). Oct 1988. 176p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC03-87DP10560. (KMSF-U–2116). Order Number DE90001996. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This paper discusses the 1988 progress at KMS Fusion on the following topics in inertial fusion: target fabrication technology; lasers; and laser-plasma interactions. (LSP)

1928 (DOE/ER/53264–2) **Experimental investigation of ICRF effects.** Herchkowitz, N. Wisconsin Univ., Madison, WI (USA). Dept. of Nuclear Engineering and Engineering Physics. [1989]. 45p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER53264. Order Number DE90001721. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

During the last year the activities of the Phaedrus Program were divided between operation of the Phaedrus-B tandem mirror and construction of the Phaedrus-T tokamak and tokamak systems. In the last few months, time devoted to design and construction of Phaedrus-T diagnostics has also become significant. The Phaedrus-T tokamak is nearing completion and expected to begin ohmic operation in July 1989. Tokamak construction has been paced by the construction of the toroidal field coils. During the last year, Phaedrus-B has been operated exclusively as an axisymmetric tandem mirror. Fueling is provided by gas puffing into either (both) the central cell to choke coil transition(s) or into either (both) the thermal barrier cell(s). Slow wave heating resulted in a high simultaneous central cell density-temperature product of $7 \times 10^{12} cm^{-3}$. 170 eV. Minority heating experiments with H-He plasmas has also resulted in high nT products. The Phaedrus Program is currently based around five physics areas, all of which involve ICRF. These are: edge physics, ponderomotive effects, mode conversion, mode control, and tandem mirror specific. The first four will involve both Phaedrus-T and Phaedrus-B. The fifth only involves Phaedrus-B and is an activity currently restricted to graduate students nearing their degrees. 13 refs., 8 figs.

1929 (EGG-FSP–8678) **Permeation of tritium through HYLIFE-II heat exchanger tubes.** Longhurst, G.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). Sep 1989. 33p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. Order Number DE90002026. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One of the significant safety concerns for the HYLIFE-II reactor design is the possibility that tritium will permeate through various parts of the reactor chamber or auxiliary systems. The most permeable part of the HYLIFE-II heat transfer system is the heat exchanger. At present the design calls for an intermediate heat exchanger in which the FLiBe primary coolant is cooled by a $NaBF_4$ intermediate loop. The very characteristics that make the heat exchanger good for transferring thermal energy make it easy for tritium to get through as well. This analysis is an attempt to estimate the rate at which tritium dissolved in the FLiBe will permeate into the secondary coolant. It is shown that permeation makes a transition from being proportional to the half power of the driving pressure to a first power law when the driving pressure becomes sufficiently low. One challenge in analyzing permeation from rapidly flowing coolant is knowing what to use for the driving pressure, since it will be substantially lower than that in the bulk of the fluid. The method of approach is to use the Lewis relation that, along with the Reynolds analogy, implies that radial transport of a dissolved constituent obeys the same model as the transport of energy and momentum, i.e., it is governed by turbulent diffusive transport rather than chemical diffusion. The key dimensionless parameters in this regard are the Schmidt number and the Reynolds number. This allows the estimation of the chemical potential of dissolved tritium at the tube surface and the subsequent determination of the permeation losses over the length of the tube provided the flow is turbulent and the methodology applies. 12 refs., 6 figs., 2 tabs.

1930 (EGG-FSP–8709) **1989 failure rate screening data for fusion reliability and risk analysis.** Cadwallader, L.C.; Piet, S.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). Sep 1989. 79p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002148. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This document contains failure rate screening data for application to fusion components. The screening values are generally fission or aerospace industry failure rate estimates that can be extrapolated for use by fusion system designers, reliability engineers and risk analysts. Failure rate estimates for tritium-bearing systems, liquid metal-cooled systems, gas-cooled systems, water-cooled systems, vacuum systems, plasma heating systems, and containment systems are given. Preliminary system availabilities, system level failure rate estimates, and selected initiating event frequency estimates are presented. This second edition document is even more valuable to design and safety analysis for the Compact Ignition Tokamak and the International Thermonuclear Experimental Reactor. 23 refs., 31 tabs.

1931 (EGG-M–88267) **MSCAP [Magnet System Circuitry Analysis Program] simulations of TESPE magnet safety transients.** Herring, J.S.; Juengst, K.P.; Jones, J.L.; Kraus, H.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881031–75: 8. topical meeting on technology of fusion energy, Salt Lake City, UT (USA), 9-13 Oct 1988). Order Number DE90001997. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During 1987, a series of tests were carried out on the TESPE Facility at the Institut fuer Technische Physik of the Kernforschungszentrum Karlsruhe in conjunction with the Idaho National Engineering Laboratory (INEL) to experimentally and analytically investigate arcing phenomena in high field superconducting magnets. One objective of the tests was to verify computer code simulations of the magnet system. TESPE is a six coil, NbTi, toroidal magnet set, designed to operate with 7 T and 8.3 MJ at 7000 A. The full TESPE circuit was modeled for four series of experiments: internal shorts during charge and discharge, arcs initiated by electrode separation, arcs initiated by a vaporizing wire, and arcs moving along two rails. 3 refs., 15 figs., 1 tab.

1932 (EGG-M–89202) **Development of the passive safety concept for ITER.** Brereton, S.J.; Holland, D.F.; Piet, S.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–40: 13. international symposium on fusion engineering,

Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002071. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Since the start of the ITER design effort, safety experts have attempted to guide designers in the development of a machine that will demonstrate the potential safety and environmental advantages of fusion. Offsite dose limits, based on regulatory requirements, have been translated into release rates or radiological inventories, which provide useful guidance to designers. The ITER team is attempting to protect the public against major accidents to the extent possible with passive means, that is, without the relying on active systems. The concept of passive safety is developed here by the US safety team for internal events and for external events that are within the envelope of design basis accidents selected for ITER. In addition to overall safety guidance, implications of passive safety for ITER systems, as envisioned by the US safety team, are discussed. An approach to implementing passive safety in ITER with reference to the blanket, plasma facing components, fuel cycle systems, plasma shutdown, and magnet design, is described. The need for a confinement building is addressed, and the role of such a building in the context of passive safety is also discussed. 6 refs., 1 fig., 3 tabs.

1933 (EGG-M–89204) **Safety implications of a graphite oxidation accident in the compact ignition tokamak device.** Merrill, B.J.; O'Brien, M.H. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–41: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002041. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper addresses the possible safety consequences of an air ingress accident for the Compact Ignition Tokamak (CIT) device. An experimental program was undertaken to determine oxidation rates of four nuclear grade graphites in air at temperatures ranging from 800 to 1800 C and flow velocities from 3 to 7 m/s. On the basis of these test results, an analytic model was developed to assess the extent of first wall/divertor protective tile oxidation and the amount of energy released from this oxidation. For CIT, a significant restriction to vacuum vessel air inflow will be provided by the air seals and walls of the surrounding test cells. Under these conditions, the graphite oxidation reaction inside the vacuum vessel will become oxygen starved within minutes of the onset of this event. Since significant oxidation rates were not achieved, the heat release did not elevate structural temperatures to levels of concern with regard to activated material release. 7 refs., 9 figs.

1934 (EGG-M–89206) **The status of superconducting magnet safety research.** Herring, J.S.; Juengst, Klaus-Peter; Thome, R.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–37: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002036. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The superconducting magnet set for a fusion reactor may store in excess of 100 GJ which must be controlled and, if necessary, safely dissipated under electrical fault conditions. While the radioactive inventory of the magnet set and its support equipment is small, the stored energy and potential off-normal forces between the coils have the capability for damaging systems which do contain large radioactive inventories. During the past eight years a coordinated series of codes, analyses, experiments and accident investigations have been carried out in the US and Europe with the goals of understanding the accident processes in magnets and developing criteria for safe magnet design. Several codes have been developed and are discussed. Each of these codes deals with a different environment and can be applied to different transient scenarios. In addition, preliminary analyses have been carried out on some large scale magnet systems to determine likely fault locations and scenarios for the purpose of developing a methodology for risk assessment. Safety specific experiments have been carried out at MIT, on the Large Coil Project at ORNL and on the TESPE facility at KfK. These experiments have served both to verify code predictions and to supply basic input data to further analyses, such as hot spot temperatures and arc voltages. This paper summarizes selected results from the above tasks. Some accidents have occurred in the course of magnet development, testing and use. By carefully, analyzing the root causes of these incidents, criteria have been studied for the design of more robust and fault-tolerant systems. 6 refs., 1 fig., 2 tabs.

1935 (EGG-M–89208) **Safety in the ARIES Tokamak Design Study.** Herring, J.S.; Wong, C.P.-C.; Cheng. E.T.; Grotz, S. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570;AC03-89ER52153. (CONF-891007–42: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002040. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Safety is one of the primary goals of the ARIES Tokamak Design Study. Public safety goals are the achievement passive safety which is demonstrable in tests that could precede operation and the assurance that releases from accidents be passively limited such that no evacuation plan in necessary. Strategies for safety of the plant investment are factory fabrication, short construction times and a design such that no off-normal operational transient results in damage which could not be repaired in routine maintenance. ARIES-I, the first of three 'visions' of potential tokamak reactors, will use He at 5 MPa as a blanket coolant and SiC/composite ceramic for the first wall and blanket materials. Both the coolant and the structural material were chosen for their low activation, both in the short term after accidents and for long term waste management. The breeder, Li_4SiO_4, was also chosen for low activation. Contemporary plasma physics and aggressive technology are used in ARIES-I, which results in very high toroidal fields (24 T maximum at the coil). The stored TF energy will be about 130 GJ. A central concern is the safe discharge of this stored energy under electrical fault conditions and prevention of a failure in the magnet set from propagating into systems containing radioactive inventories. The TF coil system consists of 16 coils, each containing two separate windings powered by two independent power supplies. Arcs and shorts between the two power supply systems and across individual windings have been modeled. In addition, delay or failure in circuit breaker opening has been modeled. The safety impacts of LOCA, LOFA and disruptive events have also been evaluated. 8 refs., 4 figs., 7 tabs.

1936 (EGG-M–89213) **A comparison of U.S. and European methods for accident scenario, identificaton, selection and quantification.** Cadwallader, L.C.; Djerassi, H.; Lampin, I. EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–39: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002051. Available from NTIS, PC A02/MF A01; OSTI; INSI; GPO Dep.

This paper presents a comparison of the varying methods used to identify and select accident-initiating events for safety analysis and probabilistic risk assessment (PRA). Initiating events are important in that they define the extent of a given safety analysis or PRA. Comprehensiveness in identification and selection of initiating events is necessary to ensure that a thorough analysis is being performed. While total completeness cannot ever be realized, inclusion of all safety significant events can be attained. The European approach to initiating event identification and selection arises from within a newly developed Safety Analysis methodology framework. This is a functional approach, with accident initiators based on events that will cause a system or facility loss of function. The US method divides accident initiators into two groups, internal accident initiators into two groups, internal and external events. Since traditional US PRA techniques are applied to fusion facilities, the recommended PRA-based approach is a review of historical safety documents coupled with a facility-level Master Logic Diagram. The US and European methods are described, and both are applied to a proposed International Thermonuclear Experiment Reactor (ITER) Magnet System in a sample problem. Contrasts in the US and European methods are discussed. Within their respective frameworks, each method can provide the comprehensiveness of safety-significant events needed for a thorough analysis. 4 refs., 8 figs., 11 tabs.

1937 (EGG-M–89214) **Identification and selection of initiating events for experimental fusion facilities.** Cadwallader, L.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570.

(CONF-891007–38: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002052. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper describes the current approaches used in probabilistic risk assessment (PRA) to identify and select accident initiating events for study in either probabilistic safety analysis or PRA. Current methods directly apply to fusion facilities as well as other types of industries, such as chemical processing and nuclear fission. These identification and selection methods include the Master Logic Diagram, historical document review, system level Failure Modes and Effects Analysis, and others. A combination of the historical document review, such as Safety Analysis Reports and fusion safety studies, and the Master Logic Diagram with appropriate quality assurance reviews, is suggested for standardizing US fusion PRA effects. A preliminary set of generalized initiating events applicable to fusion facilities derived from safety document review is presented as a framework to start from for the historical document review and Master Logic Diagram approach. Fusion designers should find this list useful for their design reviews. 29 refs., 2 tabs.

1938 (EGG-M–89216) **Volatility from copper and tungsten alloys for fusion reactor applications.** Smolik, G.R.; Neilson, R.M. Jr.; Piet, S.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–35: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002056. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Accident scenarios for fusion power plants present the potential for release and transport of activated constituents volatilized from first wall and structural materials. The extent of possible mobilization and transport of these activated species, many of which are "oxidation driven", is being addressed by the Fusion Safety Program at the Idaho National Engineering Laboratory (INEL). This report presents experimental measurements of volatilization from a copper alloy in air and steam and from a tungsten alloy in air. The major elements released included zinc from the copper alloy and rhenium and tungsten from the tungsten alloy. Volatilization rates of several constituents of these alloys over temperatures ranging from 400 to 1200°C are presented. These values represent release rates recommended for use in accident assessment calculations. 8 refs., 3 figs., 5 tabs.

1939 (EGG-M–89239) **Safety and environmental analysis of the compact ignition tokamak.** Holland, D.F.; Lyon, R.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. (CONF-891007–36: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002019. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Compact Ignition Tokamak (CIT) will use tritium as a fuel and produce sufficient high energy neutrons to activate surrounding gases and structures. This paper discusses features that have been incorporated into the design to enhance safety and reviews the safety and environmental analyses performed for the CIT. Because of the proposed location near populated areas, radioactive inventories have been kept low to limit operational and accidental releases of radioactivity. Radioactive inventories include tritium in the fueling cycle, activated nitrogen in the magnet cooling system, activated gases in the test cell, and activated solids. Features have been incorporated into the design of CIT to prevent or mitigate releases. Operational releases have been estimated and their effect on the environment calculated. Accident scenarios have been identified using a risk based approach that considers the probability as well as the consequence of the accidents. Accidents caused by equipment failures and shipping have been analyzed. Doses to the public have been calculated based on atmospheric dispersion measurements conducted at the Princeton site. These results are used to assess the adequacy of the design to meet safety and environmental objectives and requirements. 10 refs., 2 figs., 3 tabs.

1940 (EGG-M–89279) **Uranium storage bed accident hazards evaluation.** Longhurst, G.R.; Shmayda, W.T. EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891007–45: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002043. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To properly assess hazards and risks associated with the use of uranium beds as tritium storage devices in fusion reactor systems, it is necessary to understand the consequences occurring in the event of an accident. Accidents involving uranium beds are postulated, and the possible results are considered. A research program to more fully and accurately understand those results has been initiated involving the Idaho National Engineering Laboratory and Ontario Hydro. The plan and objectives of that program are presented. 11 refs., 1 tab.

1941 (KFK–4581) **The charged particle transport module CIRCE as part of the KATACO code system.** Kuefner, K.; Ligou, J.; Tran, T.M. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik. Jul 1989. 83p. Order Number DE90718225. Available from NTIS (US Sales Only), PC A05/MF A01.

The CIRCE code solves the time dependent slowing down of suprathermal ions in a one-dimensional (spherical or plane) medium. This module has been coupled to the one-dimensional plasma hydrodynamics code MEDUSA-KA in the frame of the KATACO code system. The energy deposition (to plasma ions and electrons) is calculated by CIRCE using a given hydro state provided by MEDUSA-KA. These deposition profiles are then used in MEDUSA-KA to replace the local deposition approximation used so far in the standard version. This report describes the CIRCE code and the coupling procedure between MEDUSA-KA and CIRCE. The last chapter contains a comparison between the Fokker-Planck equation used in CIRCE and the time dependent particle tracking method for the burn phase of a HIBALL target. (orig.).

1942 (KFK–4602) **NET model coil test possibilities in the TOSKA TWIN configuration.** Gruenhagen, A.; Heller, R.; Herz, W.; Hofmann, A.; Jentzsch, K.; Kapulla, H.; Kneifel, B.; Komarek, P.; Lehmann, W.; Maurer, W. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion. Jul 1989. 113p. Contract 240/86-GFU-D/NET. Order Number DE90718097. Available from NTIS (US Sales Only), PC A06/MF A01.

This report continues an earlier one on the possibilities of NET model coil testing in the TOSKA Upgrade facility at KfK. The investigation of a 'Cluster Test Facility' and a 'Solenoid Test Facility' is followed by the investigation of two further test arrangements. They are called 'Twin Configurations'. One common feature of both arrangements is that the EURATOM-LCT-coil delivers a background magnetic field. This coil should be operated at a temperature of 1.8 K and an enhanced current up to 20 kA compared to the LCT test where 3.5 K and up to 16 kA were the operating conditions. In one configuration the NET model test coil is adjacent to the LCT coil (ATC = Adjacent Twin Configuration), in the other one the NET model coil is inserted into the bore of LCT coil (ITC = Inserted Twin Configuration) either upright or with a 60°C slope. The configurations are investigated with respect to their electromagnetic mechanical and thermo-hydraulic properties. The requirements for the necessary mechanical support structure of the LCT coil were computed. Installation and cooling of the whole system were discussed. The time schedule and the costs for the test facility modification were estimated. Advantages and disadvantages for the configurations were discussed with respect to feasibility of the test arrangement and operation. (orig.).

1943 (LA-UR–89-2913) **Toroidal magnetic fields in terms of field-line invariants.** Lewis, H.R. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891182–1: International conference on plasma physics, New Delhi (India), 22-28 Nov 1989). Order Number DE89016610. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper discusses toroidal magnetic fields in terms of field-line invariants in magnetic fusion research.

1944 (LA-UR–89-3043) **Thermal analysis of the CPFR [Confinement Physics Research Facility]/ZTH apparatus.** Schnurr, N.M. Los Alamos National Lab., NM (USA). [1989]. 5p.

Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90002358. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The design has been completed for a new-generation Reversed-Field Pinch machine to be assembled at the Los Alamos National Laboratory during FY 1992. The Confinement Physics Research Facility (CPRF) houses the front-end ZTH torus. A series of simulations has been performed to predict temperature levels for various elements within the front end of the CPRF/ZTH apparatus for bakeout conditions and for periodic experiments. A lumped-parameter approach was used to calculate temperatures of various elements as functions of time. Results indicate that temperatures can be held at acceptable levels for 10-min cycles for the 2-MA design condition. The cycle time must be extended to approximately 13 min for 4-MA experiments. Instrumentation temperatures during bakeout were also found to be within acceptable limits. 2 refs., 7 figs., 1 tab.

1945 (LA-UR–89-3233) **$NaNi_3Mn_2$ alloy as a tritium storage material.** Ide, T.; Okuno, K.; Konishi, S.; Sakai, F.; Fukui, H.; Enoeda, M.; Naruse, Y.; Anderson, J.L.; Bartlit, J.R. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–50: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002357. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An all metal apparatus has been constructed and installed in the main cell of the Tritium System Assembly (TSTA) at Los Alamos National Laboratory, as a separate experiment, to handle about 2600 Ci of tritium for study of metal tritides of potential application for storing tritium in fusion fuel processing. The apparatus is similar to that used for protium/deuterium gas but some modifications were made to assure safe handling of tritium. The pressure-composition isotherms for the $LaNi_3Mn_2$-protium (H), deuterium (D) and tritium (T) system were measured to study isotopic effects in the temperature range of 60 °C to 250 °C, the pressure range below 120 kPa. 2 refs., 10 figs.

1946 (LA-UR–89-3261) **Design and drafting document control procedures for CPRF/ZTH experiment.** Pollat, L.L.; Kewish, R.W. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–51: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002356. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper will present, in general, the control procedures for design approval, review, changes, and release of engineering documents. It will also discuss interface control for tasks so that possible design interference does not occur. A document control procedure to insure that design criteria are met and technical specifications translate into workable drawings was instituted to support the Confinement Physics Research Facility (CPRF/ZTH) construction program. Our goal, to eliminate any conflicts that might arise between various tasks as the final designs are developed, required tight control and up-to-date design information. Detailed procedure for reviews were instituted, since circumventing the process of design and drafting anywhere might have proven disastrous to the CPRF/ZTH program. Design is a process of translating technical requirements, according to established standards, into drawings that are usable for fabrication and assembly. Both the designer and engineer are responsible for adhering to standards that have been established by the Mechanical Engineering Section for the CPRF/ZTH program. 6 refs., 5 figs.

1947 (LA-UR–89-3262) **CPRF/ZTH front-end torus design and fabrication status.** Ballard, E.O.; Baker, C.; Gomez, T.; Prince, P.P.; Smith, R.L. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–52: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002355. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Design of the ZTH front-end torus has been completed for a new generation Reversed Field Pinch (RFP) machine to be assembled at Los Alamos National Laboratory during FY 92. The Confinement Physics Research Facility (CPRF) houses the ZTH front-end. The ZTH torus consists of an Inconel 625 vacuum vessel supported by an external electrically conducting 304L stainless steel shell. Interspace support rings support the vacuum vessel to the shell and also provide accurate radial support for the interspace electrical diagnostics. The shell also supports 48 toroidal field coils that are mounted to the shell's external surface. The shell consists of an explosion bonded stainless steel-copper composite with water-cooling tube assemblies attached to the outer surface. The 0.135-in. thick copper is on the inside surface of the shell, and provides an electrically conducting path with the required electrical time constant of 50 ms. The shell plate will be formed to the required toroidal configuration, after which the poloidal and toroidal flanges will be welded to the structure and machined. The Inconel vacuum vessel consists of bellows segments, armor support rings, and diagnostic stations welded together to form the complete vacuum vessel assembly. The necessity for accurate positioning of the vacuum vessel within the shell requires that the shell and vacuum vessel be fabricated with major diameter tolerances within 0.050-in. true position of the nominal diameters of 188.0-in. and 188.820-in., respectively. 7 figs.

1948 (LA-UR–89-3271) **Energy ratings for metal oxide varistors under repetitively pulsed operation.** Melton, J.G. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–54: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002353. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Nonlinear resistors can be used to improve the energy transfer efficiency of inductive energy storage systems that use resistive transfer elements. Improved energy transfer efficiency can result in significant cost savings in some large systems if the cost of the nonlinear resistor is less than the cost of the energy storage and charging hardware that the resistor replaces. This report describes experimental tests that were done to determine appropriate energy ratings for ZnO Metal Oxide Varistors (MOVs) for pulsed conditions from 10 to 20 ms long. Tests were performed first on single MOV units which were forced to failure in a small number of shots. Then several sets of matched pairs were operated under identical conditions to investigate current sharing and the statistics of failure. Test results show that the standard rating method used by manufacturers relating peak current, pulse length, and expected lifetime are adequate, but somewhat conservative. The manufacturers' energy ratings project to a very economical nonlinear transfer resistor. 7 refs., 4 figs., 1 tab.

1949 (LA-UR–89-3276) **Electrical insulation system for the shell-vacuum vessel and poloidal field gap in the ZTH machine.** Reass, W.A.; Ballard, E.O. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–57: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002351. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The electrical insulation systems for the ZTH machine have many unusual design problems. The poloidal field gap insulation must be capable of conforming to poloidal and toroidal contours, provide a 25 kV hold off, and sufficiently adhere to the epoxy back fill between the overlapping conductors. The shell-vacuum vessel system will use stretchable and flexible insulation along with protective hats, boots and sleeves. The shell-vacuum vessel system must be able to withstand a 12.5 kV pulse with provision for thermal insulation to limit the effects of the 300°C vacuum vessel during operation and bakeout. Methodology required to provide the electrical protection along with testing data and material characteristics will be presented. 7 figs.

1950 (LA-UR–89-3279) **Separation of helium and hydrogen isotopes by ISS [Isotope Separation System] at the TSTA.** Enoeda, M.; Fukui, H.; Ide, T.; Okuno, K.; Naruse, Y.; Anderson, J.L.; Bartlit, J.R.; Sherman, R.H.; Willms, R.S. Los Alamos National Lab., NM (USA). [1989]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–59: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002348. Available from NTIS, PC A03/MF A01; OSTI; INIS.

Separation experiments were performed with Isotope Separation System (ISS) at the TSTA from 1988 through 1989. These experiments included two column experiments with D-T mixture and four column experiments with D-T mixture and impurities (He and H_2). The objectives of these experiments were to obtain fundamental data of cryogenic distillation columns under wider range of operational condition than previous work, to observe the influence of He on the operation of cryogenic distillation columns, and to obtain fundamental data of cryogenics distillation columns under the influence of He. 2 refs., 7 figs., 2 tabs.

1951 (LA-UR–89-3280) **Tritium handling safety and operating experience at the Tritium Systems Test Assembly.** Carlson, R.V. Los Alamos National Lab., NM (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–60: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002347. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory is a facility designed to develop and demonstrate, in full scale, technologies necessary for safe and efficient operation of tokamak fusion reactors. TSTA currently consists of systems for pumping DT gas mixtures; for removing impurities; for separating the isotopes of hydrogen; for storage of hydrogen isotopes; for gas analysis; and for assuring safety by the necessary control, monitoring, and detritiation of effluent gaseous streams. TSTA also has several small scale experiments to develop and test new equipment and processes necessary for fusion reactors. Tritium was introduced into TSTA in June 1984. Current inventory is approximately 100 grams. Approximately 10^9 Curies of tritium have been processed in closed loop operation at TSTA. Total tritium releases from the facility stack have been less than 75 Curies. Total operating personnel exposures are less than 500 person-mrem. Exposures to the general public from TSTA tritium releases are extremely small (less than 10^{-2} mrem). Total tritium buried as waste is less than 36,000 Curies. In this paper, data on component reliability, failure types and rates, and waste quantities are presented. Operational experience under normal, abnormal, and emergency conditions is presented. The DOE requirements for the operation of a tritium facility like TSTA include personnel training, emergency preparedness, radiation protection, safety analysis, and preoperational appraisals. 4 refs., 3 figs., 3 tabs.

1952 (LA-UR–89-3281) **Dispersion and removal of tritium released into the main cell TSTA [Tritium Systems Test Assembly].** Bartlit, J.R.; Anderson, J.L.; Jalbert, R.A.; Carlson, R.V.; Okuno, K.; Ide, T.; Fukui, H.; Enoeda, M.; Naruse, Y. Los Alamos National Lab., NM (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–47: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002346. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Approximately 145 millicuries (about 0.06 cm^3) of tritium in DT form were released into the main cell of the Tritium Systems Test Assembly at Los Alamos National Laboratory. At equilibrium with the cell isolated, this amount resulted in concentrations of about 50 microcuries per cubic meter throughout the 2900 m^3 of the cell volume. Tritium was held in the cell for 29 minutes before normal ventilation was restored and the tritium was released through the facility's 30-m stack. The dispersion, confinement, removal, and decontamination times associated with this release are discussed in this paper. 5 refs., 2 figs., 3 tabs.

1953 (LA-UR–89-3291) **High speed transfer switch with 50 kA and 50 kV.** Reass, W.A.; Kasik, R.J.; Wilds, W.A. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–61: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002448. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper gives the mechanical design and electrical parameters of a pneumatically operated transfer switch. This design is used to switch 3-second 50-kA current pulses, and is easily capable of 75 kA operation (2×10^{10} I^2t); with water-cooled versions capable of 20 kA continuously. Although the switch is not specifically designed to make or break 50 kA, it is provided with auxiliary Elkonite arcing contacts have proven their value in protecting the main electrodes even under repetitive (50 kA) fault conditions. Included in this presentation will be the results of extensive life testing and associated criteria. 6 figs., 1 tab.

1954 (LA-UR–89-3293) **2000 MCM electrical power jumper cable with controlled flexibility: Design and life cycle test.** Bultman, D.H.; Sims, J.R.; Reass, W.A. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–70: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002446. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The ZTH Reversed Field Pinch (RFP) plasma confinement experiment being built at the Los Alamos National Laboratory will use magnet coils to provide ohmic heating currents in the plasma. The ohmic heating coils are supported by a structure that will allow them limited movement with respect to surrounding hardware and the connecting electrical bus work. To minimize displacement-induced stresses in the coils, "flexible" power conducting links are necessary to accommodate the relative motion between the bus work and the coils. A semi-flexible 2000 MCM jumper cable has been designed with enough flexibility to allow free movement of the coils, yet it is stiff enough to withstand large magnetically-induced lateral loads and minimize the effect of the lateral loads on the magnet coil leads. A full-power life cycle test of the jumper was performed under magnetic, thermal and dynamic loads that closely simulate the expected operating conditions. This test evaluated the structural and electrical integrity of the jumper as well as the quality and reliability of the bolted electrical connections at the jumper ends in a high-stress, cyclic-loading environment. The jumper cable design is presented with an explanation of the requirements for a semi-flexible link. A description of the life cycle test and test results are given, as well as a description of the test apparatus and setup. 4 figs.

1955 (LA-UR–89-3298) **Remote controlled signal conditioner and fiber optic data link system development CPRF (Confinement Physics Research Facility).** Schrank, L.S.; Caudill, L.D.; Haberstich, A.; Klare, K.A.; Reass, W.A. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–68: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002444. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The ZTH reversed-field pinch to be installed in the Confinement Physics Research Facility (CPRF) will produce a significant ambient magnetic field. To avoid ground-loop and other electrical problems, the diagnostics in direct or possible contact with the experiment will be accessed through a fiber optic data way. The frequency-modulated analog links developed for this system have a bandwidth of dc to 100 kHz and a signal-to-noise ratio of better than 60 dB. The fiber optic transmitter units include a signal conditioner and a microprocessor controller. The conditioners can be configured as dc-coupled, low-noise differential amplifiers, or as high-gain, low-drift differential integrators with a very long droop time constant. Magnetic field pickup is minimized by balancing sensitive circuit areas to within 5 mm^2 in all three planes of the PC boards. The gain, offset, and integrator reset are controlled and monitored by the microprocessor, and their status is displayed on the front panel of the transmitter unit. The signal conditioner can be controlled locally, or by way of a fiber optic coupled control network. The system allows fast, convenient, noise-immune control of a large number of signal conditioners from a central host computer. By varying the offset, the computer can verify the operational integrity of the data links. 2 refs., 6 figs.

1956 (LA-UR–89-3299) **Confinement Physics Research Facility/ZTH: A progress report.** Hammer, C.F.; Thullen, P. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–67: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002443. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In October 1985 the Los Alamos National Laboratory's Controlled Thermonuclear Research (CTR) Division began the design and construction of the Confinement Physics Research Facility (CPRF) and the ZTH toroidal, reversed-field-pinch (RFP), plasma physics experiment. The CPRF is a facility which will provide the buildings, utilities, pulsed power system, control system and diagnostics needed to operate a magnetically confined fusion experiment, and ZTH will be the first experiment operated in the facility. The construction of CPRF/ZTH is scheduled for completion in the first quarter of 1993. 5 figs.

1957 (LA-UR–89-3322) **The design of the CPRF [Confinement Physics Research Facility] control system.** Wilkins, R.W.; Klingner, P.L. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–66: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002442. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Confinement Physics Research Facility (CPRF), currently under construction at Los Alamos, is a facility for research into the plasma confinement properties of various magnetic field configurations. The first device to be tested in the CPRF will be ZTH, a reversed field pinch. The CPRF/ZTH control system has been designed as a distributed system with four major semi-independent subsystems. Each subsystem will be capable of stand-alone operation for purposes of commissioning and maintenance. The subsystem controller hardware has been selected; it will consist of commercially available programmable logic controllers (PLCs) linked by a fast fiber optic network. The man-machine interface, which is under procurement as of June, 1989, will have multiple graphic workstations interfaced to the PLC fiber optic network. The central control console will initially have three stations. Permanent local stations will be located at two of the subsystems with a transportable station serving the remaining subsystems. Standard process control software will be used, but the selection criteria emphasize the open architecture of the system so that user programs can be easily integrated. 2 figs.

1958 (LA-UR–89-3352) **The ARIES-I high-field-tokamak reactor: Design-point determination and parametric studies.** Miller, R.L. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–56: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002435. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The multi-institutional ARIES study has examined the physics, technology, safety, and economic issues associated with the conceptual design of a tokamak magnetic-fusion reactor. The ARIES-I variant envisions a DT-fueled device based on advanced superconducting coil, blanket, and power-conversion technologies and a modest extrapolation of existing tokamak physics. A comprehensive systems and trade study has been conducted as an integral and ongoing part of the reactor assessment in order to identify an acceptable design point to be subjected to detailed analysis and integration as well as to characterize the ARIES-I operating space. Results of parametric studies leading to the identification of such a design point are presented. 15 refs., 6 figs., 2 tabs.

1959 (LA-UR–89-3353) **Fusion fuel purification during the Tritium Systems Test Assembly 3-week loop experiment.** Willms, R.S. Los Alamos National Lab., NM (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–55: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002434. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During the time period from April 19, 1989–May 5, 1989, the Tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory (LANL) conducted its longest continuous integrated loop operation to date. This provided an opportunity to test some hitherto unproven capabilities of the TSTA Fuel Cleanup System (FCU). Previous FCU tests were reported. The purpose of the FCU is to remove impurities from a stream of hydrogen isotopes (Q_2) representative of torus exhaust gas. During this run impurities loadings ranging from 60 to 179 sccm of 90% N_2 and 10% CH_4 were fed to the FCU. Each of the two FCU main flow molecular sieve beds (MSB's) were filled to breakthrough three times. The MSB's were regenerated during loop operations. 2 refs., 6 figs., 2 tabs.

1960 (LA-UR–89-3382) **Design and construction status of the energy system for the ZTH experiment.** Boenig, H.J.; Gribble, R.F.; Melton, J.G.; Hammer, C.F.; Huddleston, S.W.; Konkel, H.E.; Reass, W.A.; Rogers, J.D.; Rosev, B.J.; Schillig, J.B. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–62: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002392. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A large scale reversed-field pinch fusion experiment, called ZTH, is being designed and built at Los Alamos. Initially, the machine will be operating at a 1.7 MA plasma current, however, the machine can be upgraded to a 4 MA current with many of the components, such as the torus, coil system and electrical power source already having the 4 MA capability. The first plasma discharges are expected to take place in the spring of 1993. Major electrical power equipment components, such as a 1430 MVA generator, controlled power supplies, isolation and opening switches, current interrupter, capacitor banks and transfer resistor are being designed and procured for this experiment. The design philosophy of the electrical system is explained. Test results of in-house research are described and the procurement status of the major components are summarized. 6 refs., 2 figs.

1961 (LA-UR–89-3383) **Design of the Los Alamos generator installation.** Boenig, H.J.; Schillig, J.B.; Rogers, J.D.; Huddleston, S.W.; Konkel, H.E.; Rosev, B.J. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–63: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002391. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A 1430 MVA synchronous generator from a cancelled nuclear power plant is being installed at Los Alamos to be used as the pulsed power generator for the Confinement Physics Research Facility. The generator is mounted on a spring foundation to avoid dynamic forces from being transmitted to the substructure and the ground. A 6 MW load-commutated inverter drive will accelerate the machine from standstill to the maximum operating speed of 1800 rpm and from 1260 rpm to 1800 rpm between load pulses. The generator cooling method is being changed from hydrogen to air cooling. A current limiting fuse, with a fuse clearing current of 80 kA, will protect the generator output against short circuit currents. Changes in the excitation system are described. A status report of the installation and an approximate schedule for completing the installation are presented. The paper also addresses results of special studies and tests undertaken to evaluate the condition of the generator and to predict the behavior of some critical mechanical generator components under pulsed loading conditions. 1 ref., 4 figs., 2 tabs.

1962 (LA-UR–89-3482) **Tritium contamination studies involving test materials and jet remote handling tools.** Tesini, A.; Jalbert, R. Los Alamos National Lab., NM (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–46: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002406. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To determine the potential contamination of remote cutting and welding tools to be used in the JET torus after the introduction of tritium, experiments were performed using these tools on INCONEL pipe specimens which had been exposed to elemental tritium (HT) at a concentration of 4.6×10^{10} Bq/m^3. A maximum tritium release of ~15,600 Bq was measured during welding, resulting in the tool's surface contamination of 0.5 Bq/cm^2. A second series of tests was performed in order to determine the degree of surface contamination of various materials when exposed to HTO as a function of the exposure time and the relative efficacy of different decontamination techniques. Stainless steel, aluminium alloy and PVC rigid were exposed to HTO (liquid) at a concentration 4.4×10^{10} Bq/l for 1, 24,

120 hours and decontaminated. The decontamination techniques used included; leaching in water, baking at 100°C, hot air stream, weathering. The maximum levels of tritium surface contamination measured during the test were ~12 Bq/cm^2 for stainless steel, ~ Bq/cm^2 for aluminium alloy and ~1,700 Bq/cm^2 for PVC. A decontamination factor of about 80% as measured by smears was achieved using hot air stream at 125°C on stainless steel and aluminium alloy and baking PVC at 100°C. 6 figs., 2 tabs.

1963 (ORNL/FTR–2918) **[Studies on fusion materials]: Foreign trip report, June 5, 1989–June 15, 1989.** Grossbeck, M.L. Oak Ridge National Lab., TN (USA). 29 Jun 1988. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001742. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The workshop at Petten formulated the procedures to establish an international data base for use by the designers of cooperative fusion devices such as the International Thermonuclear Experimental Reactor (ITER). An organizational structure was proposed and key people were identified to provide data for analysis and for incorporation into the data base. At Mol, tensile and fatigue data from irradiation experiments in the High Flux Reactor (HFR) in Petten, The Belgian Reactor (BR 2), and the High Flux Isotope Reactor (HFIR) were discussed. Two important effects were supported by the data: there appears to be no effect of helium on mechanical properties below 300°C; and at 550°C and above, helium decreases fatigue life at low strain rates.

1964 (ORNL/FTR–2920) **[International Energy Agency workshop on fusion materials database]: Foreign trip report, June 5, 1988–June 11, 1988.** Davis, J.W. Oak Ridge National Lab., TN (USA). 23 Jun 1988. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001743. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report describes the chain of events leading up to the IEA Workshop on Materials Database and the decisions reached at this Workshop regarding the creation of an international materials handbook.

1965 (ORNL/FTR–2950) **[Advanced ceramics for fusion applications]: Foreign trip report, June 17, 1988–June 25, 1988.** Beatty, R.L. Oak Ridge National Lab., TN (USA). 11 Jul 1988. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001745. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report outlines a two-day Japan/US workshop on "Advanced Ceramics for Fusion Applications." The workshop program was devoted half to work resulting directly from United States or Japanese fusion materials programs and half to more general advanced ceramics of related interest. Also outlined are visits to four Japanese institutions engaged in advanced ceramics research and development. An evaluation of the status of Japanese fusion ceramics technology and recommendations for future United States work direction will be addressed in a later report prepared by the United States workshop team.

1966 (ORNL/FTR–3010) **[Low activation alloys for fusion reactors]: Foreign trip report, August 13, 1988–August 27, 1988.** Grossbeck, M.L. Oak Ridge National Lab., TN (USA). 9 Sep 1988. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002125. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A major effort in development of low activation materials for fusion reactor first wall and blanket structures has been carried on at the JRC, Ispra, for a number of years. This research and, in particular, the areas of overlap with similar research at ORNL were discussed. In addition, irradiation creep research using cyclotron irradiation was discussed. The results were found to support recent results from neutron irradiations at ORNL. In the meeting at Garching, properties of candidate materials for the ITER were discussed in detail. It was recommended that the ITER designers use Type 316L stainless steel for the first wall and blanket structures but also conduct the design studies with PCA and a low activation austenitic steel as well.

1967 (ORNL/FTR–3031) **[Materials for magnetic fusion energy systems]: Foreign trip report, August 30, 1988–September 9, 1988.** Rowcliffe, A.F. Oak Ridge National Lab., TN (USA). 22 Sep 1988. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001299. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the visit of a US delegation to the USSR to plan a cooperative research program in the area of materials for magnetic fusion reactor systems. Information on the USSR work on the development of reduced activation austenitic steels is summarized and the main features of the agreement on cooperative research are described.

1968 (ORNL/FTR–3421) **[Radiation damage correlation for fusion conditions]: Foreign trip report, September 25, 1989–October 5, 1989.** Stoller, R.E. Oak Ridge National Lab., TN (USA). 19 Oct 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001712. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The correlation of data from fusion reactor experiments and various acceleration-based irradiation facilities was discussed in 22 formal presentations (including the traveler's) and in informal discussions among the 39 participants of the workshop. A major focus of the meeting was the influence of high energy cascades and whether subcascade formation mitigated their importance. The influence of the neutron spectrum on the fraction of point defects that survive the initial cascade was discussed in some detail. A general consensus appears to be that only a small (perhaps 1 to 10%) of the defects survive and that the fraction may be higher for lower energy cascades. Void swelling and mechanical property data from various reactor and ion irradiation experiments were discussed in the context of our present understanding of neutron flux and spectral effects and the influence of solid and gaseous transmutants.

1969 (PPPL–2656) **The tokamak as a neutron source.** Hendel, H.W.; Jassby, D.L. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90001821. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This paper describes the tokamak in its role as a neutron source, with emphasis on experimental results for D-D neutron production. The sections summarize tokamak operation, sources of fusion and non-fusion neutrons, principal neutron detection methods and their calibration, neutron energy spectra and fluxes outside the tokamak plasma chamber, history of neutron production in tokamaks, neutron emission and fusion power gain from JET and TFTR (the largest present-day tokamaks), and D-T neutron production from burnup of D-D tritons. This paper also discusses the prospects for future tokamak neutron production and potential applications of tokamak neutron sources. 100 refs., 16 figs., 4 tabs.

1970 (PPPL–2658) **Cryosorption of helium on argon frost TFTR [Tokamak Fusion Test Reactor] neutral beamlines.** Kamperschroer, J.H.; Cropper, M.B.; Dylla, H.F.; Garzotto, V.; Dudek, L.E.; Grisham, L.R.; Martin, G.D.; O'Connor, T.E.; Stevenson, T.N.; von Halle, A. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90001823. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Helium pumping on argon frost has been investigated on TFTR neutral beam injectors and shown to be viable for limited helium beam operation. Maximum pumping speeds are ~ 25% less than those measured for pumping of deuterium. Helium pumping efficiency is low, > 20 argon atoms are required to pump each helium atom. Adsorption isotherms are exponential and exhibit a two-fold increase in adsorption capacity as the cryopanel temperature is reduced from 4.3 K to 3.7 K. Pumping speed was found to be independent of cryopanel temperature over the temperature range studied. After pumping a total of 2000 torr-l of helium, the beamline base pressure rose to 2×10^{-5} torr from an initial value of 10^{-8} torr. Accompanying this three order of magnitude increase in pressure was a modest 40% decrease in pumping speed. The introduction of 168 torr-l of deuterium prior to helium injection reduced the pumping speed by a factor of two with no decrease in adsorption capacity. 29 refs., 7 figs.

1971 (UCRL–101063) **A 14-MeV beam-plasma neutron source for materials testing.** Futch, A.H.; Coensgen, F.H.; Damm, C.C.; Molvik, A.W. Lawrence Livermore National Lab., CA (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-891007–44: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002234. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The design and performance of 14-MeV beam-plasma neutron sources for accelerated testing of fusion reactor materials are described. Continuous production of 14-MeV neutron fluxes in the range of 5 to 10 MW/m^2 at the plasma surface are produced by D-T reactions in a two-component plasma. In the present designs, 14-MeV neutrons result from collisions of energetic deuterium ions created by transverse injection of 150-keV deuterium atoms on a fully ionized tritium target plasma. The beam energy, which deposited at the center of the tritium column, is transferred to the warm plasma by electron drag, which flows axially to the end regions. Neutral gas at high pressure absorbs the energy in the tritium plasma and transfers the heat to the walls of the vacuum vessel. The plasma parameters of the neutron source, in dimensionless units, have been achieved in the 2XIIB high-β plasma. The larger magnetic field of the present design permits scaling to the higher energy and density of the neutron source design. In the extrapolation, care has been taken to preserve the scaling and plasma attributes that contributed to equilibrium, magnetohydrodynamic (MHD) stability, and microstability in 2XIIB. The performance and scaling characteristics are described for several designs chosen to enhance the thermal isolation of the two-component plasmas. 11 refs., 3 figs., 3 tabs.

1972 (UCRL–102100) **Starlight: A stationary inertial-confinement-fusion reactor with nonvaporizing walls.** Pitts, J.H. Lawrence Livermore National Lab., CA (USA). 30 Sep 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891007–49: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002315. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Starlight concept for an inertial-confinement-fusion (ICF) reactor utilizes a softball-sized solid-lithium x-ray and debris shield that surrounds each fuel pellet as it is injected into the reactor. The shield is sacrificial and vaporizes as it absorbs x-ray and ion-debris energy emanating from the fusion reactions in the fuel pellets. However, the energy deposition time at the surface if the first wall is lengthened by four orders of magnitude (to > 100 μs) which allows the energy to be conducted into the wall fast enough to prevent vaporization. Starlight operates at 5 Hz with 300-MJ-yield fuel pellets. It features a stationary, nonvaporizing first wall that eliminates erosion and shock waves which can destroy the wall; also, it allows arbitrary fuel pellet illumination geometries so that efficient coupling of either laser or heavy ion beam driver energy to the fuel pellet can be achieved. When neutrons penetrate the shield, the wall experiences neutron damage that limits its lifetime. Hence, we must choose wall materials that have ab economic lifetime. We describe the general concept and a specific design for laser drivers using a 6-m-radius, 2 1/4 Cr 1 Mo steel first wall. We include heat transfer calculations used to establish the radius and structural analysis that shows stresses are within allowable limits. A wall lifetime of over six years is predicted. 19 refs., 2 figs.

1973 **Applications of neutral beam and RF technologies.** Haselton, H.H. (Oak Ridge National Lab., TN (USA)). *Journal of Fusion Energy (USA),* 6(4): 345-350 (Dec 1987). DOE Contract AC05-84OR21400. (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

This presentation provides an update on the applications of neutral beams and radio-frequency power in the fusion program. Highlights of the ion cyclotron heating experiments now in progress as well as the neutral beam experiments are given and heating requirements of future devices and some of the available options are assessed. Antenna designs and requirements are evaluated. Some remarks on current drive are presented. Several collaborations of critical importance to the program are identified. Rf experiments underway at the TFTR, the JET, the Tore Supra, and the JT-60 tokamaks are reviewed.

1974 **Status of inertial confinement fusion.** Schriever, R.L. (Dept. of Energy, Washington, DC (USA)). *Journal of Fusion Energy (USA),* 6(4): 371-389 (Dec 1987). (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

Technical, institutional, and financial assessments are made of inertial confinement fusion programs in the United States. Among the programs discussed are the Particle Beam Fusion Accelerator at Sandia, the AURORA facility at Los Alamos, the Heavy Ion Fusion Accelerator at Lawrence Berkeley Laboratory, the OMEGA glass laser system and facility, and the fusion research program at the University of Rochester. Target, diagnostic, heating, and other areas of research are discussed. Prospects for the future of fusion research within the context of the current energy scenario in the country are evaluated.

1975 **Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility.** Kumar, A. (California Univ., Los Angeles, CA (USA)); Leo, W.R.; Green, L.; Woodruff, G.L. *Fusion Technology (USA),* 15(3): 1430-1450 (May 1989).

Transmitted neutron spectra from slabs of beryllium, lead, stainless steel, ThO_2, Li_2CO_3, and graphite, driven by a Haefely neutron generator operated at low intensity, were measured with a 2- x 2-in. NE-213 detector at the LOTUS facility. These materials investigated under our fusion blanket neutronics program. In this paper, these experiments are analyzed with the two-dimensional code DOT3.5 and the three-dimensional code MCNP. The discrepancies on spectral integrals between 15 and 1 MeV are within 10 to 15% for empty cavity, 15-cm-thick lead, 18-cm beryllium, and 25-cm graphite slabs for both three-dimensional (MCNP) and two-dimensional (DOT) computations as compared to those obtained from the measured spectra; much larger differences are found for 6.,2-cm-thick stainless steel, 15-cm Li_2CO_3, and 27.7-cm ThO_2 slabs. Also, there is a considerable disagreement over pointwise spectra for a number of slabs.

1976 **The data acquisition and control system for Thomson scattering on ATF.** Stewart, K.A. (Oak Ridge National Lab., TN (USA)); Rasmussen, D.A.; Kindsfather, R.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1660-1664 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

The two-dimensional Thomson scattering system measuring electron temperatures and densities in the Advanced Toroidal Facility (ATF) is interfaced to a VAX-8700 computer system running in a clustered configuration. Calibration, alignment, and operation of this diagnostic are under computer control. Extensive CAMAC instrumentation is used for timing control, data acquisition, and laser alignment. This paper discusses the computer hardware and software, system operations, and data storage and retrieval.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 1232

9901 Management

Refer also to citation(s) 403, 482, 999, 1620, 1621, 2011

1977 (UCRL–101695) **A study of the utilization of ex-managers.** Austin, A.L. Lawrence Livermore National Lab., CA (USA). Nov 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891198–1: 6. IEEE careers conference: engineering and engineering managers: challenges of the 90's, St. Petersburg, FL (USA), 1-3 Nov 1989). Order Number DE90000818. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The basic purpose of the study was to identify the problems of ex-manager utilization, evaluate their seriousness, and to develop

recommendations for solutions, if necessary. The scope and direction of the study was defined by the formulation of the following questions: Is this valuable human resource effectively utilized? How can we unsure optimal reassignments to maximize benefits to all? What are the issues, problems, and solutions? What changes in policies and practices are needed? Although these questions were continually reassessed and many variations were considered, they remained as the framework defining the basic charter for the study group. 1 fig.

9902 Mathematics and Computers

Refer also to citation(s) 57, 90, 120, 125, 128, 155, 161, 162, 163, 167, 177, 216, 239, 267, 356, 391, 393, 422, 458, 459, 460, 461, 470, 471, 473, 480, 498, 504, 509, 548, 591, 631, 689, 690, 691, 737, 766, 837, 899, 939, 981, 991, 1014, 1051, 1060, 1067, 1069, 1070, 1087, 1088, 1095, 1126, 1127, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1148, 1165, 1175, 1209, 1215, 1231, 1233, 1328, 1329, 1375, 1394, 1544, 1697, 1764, 1811, 1812, 1830, 1831, 1833, 1874, 1878, 1893, 1913, 1975, 1976

1978 (AD-A–204210/9/XAB) **J-machine: System support for actors. Memorandum report.** Dally, W.J. Massachusetts Inst. of Tech., Cambridge, MA (USA). Microsystems Research Center. Dec 1988. 33p. (VLSI-M–88-491). Available from NTIS, PC A03/MF A01.

The J-Machine in concert with its operating system kernel, JOSS, provides low-overhead system services to support actor programming systems. The J-Machine is not specialized to actor systems: instead, it provides primitive mechanisms for communication, synchronization, and translation. Communication mechanisms are provided that permit a node to send a message to any other node in the machine in < 2 microsecs. On message arrival, a task is created and dispatched in < 1 microsec. A translation mechanism supports a global virtual address space. These mechanisms efficiently support most proposed models of concurrent computation. The hardware is an ensemble of up to 65,536 nodes each containing a 36-bit processor, 4K 36-bit words of memory, and a router. The nodes are connected by a highspeed 3-D mesh network. The design was chosen to make the most efficient use of available chip and board area.

1979 (AD-A–209901/8/XAB) **System theoretic models for high-density VLSI (very large scale integration) structures. Final technical report.** Dickinson, B.W.; Hopkins, W.E. Princeton Univ., NJ (USA). Dept. of Electrical Engineering and Computer Science. 1989. 42p. Available from NTIS, PC A03/MF A01.

This research project involved the development of mathematical models for analysis, synthesis, and simulation of large systems of interacting devices. The work was motivated by problems that may become important in high-density VLSI chips with characteristic feature sizes less than 1 micron: it is anticipated that interactions of neighboring devices will play an important role in the determination of circuit properties. It is hoped that the combination of high device densities and such local interactions can somehow be exploited to increase circuit speed and to reduce power consumption. To address these issues from the point of view of system theory, research was pursued in the areas of nonlinear and stochastic systems and into neural-network models. Statistical models were developed to characterize various features of the dynamic behavior of interacting systems. Random-process models for studying the resulting asynchronous modes of operation were investigated. The local interactions themselves may be modeled as stochastic effects. The resulting behavior was investigated through the use of various scaling limits, and by a combination of other analytical and simulation techniques. Techniques arising in a variety of disciplines where models of interaction have been formulated and explored were considered and adapted for use.

1980 (AD-A–210176/4/XAB) **Distribution of processing tasks for the REMIDS II real-time processor system. Technical report.** Horner, R. Environmental Research Inst. of Michigan, Ann Arbor, MI (USA). 1 Jun 1989. 9p. (ERIM–209700-2-T). Available from NTIS, PC A02/MF A01.

The demonstration system must perform many different operations to successfully locate minefields in real time. These operations fall into the categories of: Scanner data input, Scanner data processing, Inter-processor communication, and Display data output. The time-line also provides an overall view of the operations from which system-level requirements may be derived. For instance, it shows three parallel processes occuring concurrently on the DAP-610. Support of this concurrent processing from AMT would be necessary to keep program development costs down. Also there is a three-image-acquisition aperture time delay between first starting to acquire a scanner image and having results ready to display. This implies three images must be buffered in the DAP-610 in addition to any temporary storage needed for the algorithm execution. Finally, the time-line indicates a framing image display. Any additional computations for a scrolling display (vertical decimation, image shifting) would have to be distributed in time during the other processing and would have to be repeated at least ten times per second (preferably 30 times per second) to attain a smooth scroll appearance.

1981 (BONN-IR–89-09) **Development of the software of the data taking system SOS for the SAPHIR experiment.** Manns, J. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Feb 1989. 92p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The data acquistion system SOS has been developed for the SAPHIR experiment at the Bonn stretcher ring ELSA. It can handle up to 280 kilobytes of data per second or a maximum triggerrate of 200 Hz. The multiprocessor based online system consists of twenty VIP-microprocessors and two VAX-computers. Each component of the SAPHIR experiment has at least one program in the online system to maintain special functions for this specific component. All of these programs can receive event data without interfering with the transfer of events to a mass storage for offline analysis. A special program SOL has been developed to serve as a user interface to the data acquisition system and as a status display for most of the programs of the online system. Using modern features like windowing and mouse control on a VAX-station the SAPHIR online SOL establishes an easy way of controlling the data acquisition system. (orig.).

1982 (CONF-880551–Summs.) **Summary of papers to be presented at the Eleventh computer security group conference.** Krull, A.R. USDOE, Washington, DC (USA). 1988. 150p. Sponsored by U.S. DOE Management & Administration. From 11. DOE computer security group conference; Kansas City, MO (USA); 3-5 May 1988. Order Number DE90001114. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This article describes a strategy for gaining greater compliance - - greater than otherwise might be achieved. User Friendly Security (UFS) is defined, a rationale for its use is offered, and examples of UFS are given. From these examples you may judge where you and your organization stand with respect to others. Security will be recognized more as a profession, and less as an occupation, as user-friendliness is made a key component in the implementation of any security measure.

1983 (CONF-891113–4) **Application of neural networks for fault diagnosis in plant production.** Ferrada, J.J.; Gordon, M.D.; Osborne-Lee, I.W. Oak Ridge National Lab., TN (USA). Oct 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989. Order Number DE90001964. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sixth-generation computers, in Japan, have been announced as natural intelligence computers that would display behaviors based on biological rather than silicon models. These systems are derived from neurological models or neural networks that consist of a number of simple, highly interconnected processing elements which process information by their dynamic-state response to external inputs. The neural network is made by specifying interconnections, transfer functions, and training laws of the network. Then appropriate inputs are applied to the network, and it is allowed to react. The overall state of the network after it has reacted to the input will be the desired response pattern. This paper explores the potential for using simple networks for data interpretation. The ultimate goal of our study includes the interpretation of industrial plant monitoring

data for diagnosis of chemical process or other process problems. Known data about normal operations, as well as abnormal operations and its causes, can be taught to the system. The system will apply a learning mechanism to the data in order to acquire knowledge. By supplying operational data, the system will indicate the nature of the fault, if any exists. 5 refs., 10 figs.

1984 (CONF-891149–8) **A block QR factorization algorithm using restricted pivoting.** Bischof, C.H. Argonne National Lab., IL (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. From Supercomputing '89 conference; Reno, NV (USA); 13-17 Nov 1989. Order Number DE90001921. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents a new algorithm for computing the QR factorization of a rank-deficient matrix on high-performance machines. The algorithm is based on the Householder QR factorization algorithm with column pivoting. The traditional pivoting strategy is not well suited for machines with a memory hierarchy since it precludes the use of matrix-matrix operations. However, matrix-matrix operations perform better on those machines than matrix-vector or vector-vector operations since they involve significantly less data movement per floating point operation. We suggest a restricted pivoting strategy which allows us to formulate a block QR factorization algorithm where the bulk of the work is in matrix-matrix operations. Incremental condition estimation is used to ensure the reliability of the restricted pivoting scheme. Implementation results on the Cray 2, Cray X-MP and Cray-Y-MP show that the new algorithm performs significantly better than the traditional scheme and can more than halve the cost of computing the QR factorization. 36 refs., 3 tabs.

1985 (CONF-8811259–1) **Numerical bifurcation analysis and parallel processing.** Adomaitis, R.A.; Cinar, A. Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering. 1988. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13696. From Conference on the use of advanced computer architectures in chemical engineering; Washington, DC (USA); 27 Nov - 2 dec 1988. Order Number DE89017908. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A numerical scheme has been developed for determining the global static bifurcation characteristics of a nonlinear system. Based on the desirable properties of equilibrium solution surfaces in certain coordinate systems, its utility also extends to the task of classifying the different multiplicity patterns found in the remaining parameter space. An outline of the numerical technique and a discussion of its inherent parallelizability will be presented in this paper. 5 refs., 6 figs.

1986 (CONF-8909231–1) **A graphics tool to aid in the generation of parallel FORTRAN programs.** Brewer, O.; Dongarra, J.; Sorensen, D. Argonne National Lab., IL (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Computer software and applications conference; Orlando, FL (USA); 20-22 Sep 1989. Order Number DE90001429. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a graphics tool called BUILD that can be used to help automate the process of writing parallel FORTRAN programs for the SCHEDULE package. The user can interactively build an execution graph that describes his algorithm and then have the tool generate the necessary calls to the SCHEDULE package. We describe the tool and its use and then we present some examples that have been built using the tool. 6 refs., 5 figs.

1987 (CONF-8910246–1) **Elicitation of natural language representations of uncertainty using computer technology.** Tonn, B.; Goeltz, R.; Travis, C. Oak Ridge National Lab., TN (USA). [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual meeting of the Society for Risk Analysis; Washington, DC (USA); 31 Oct - 2 nov 1989. Order Number DE90001416. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Knowledge elicitation is an important aspect of risk analysis. Knowledge about risks must be accurately elicited from experts for use in risk assessments. Knowledge and perceptions of risks must also be accurately elicited from the public in order to intelligently perform policy analysis and develop and implement programs. Oak Ridge National Laboratory is developing computer technology to effectively and efficiently elicit knowledge from experts and the public. This paper discusses software developed to elicit natural language representations of uncertainty. The software is written in Common Lisp and resides on VAX Computers System and Symbolics Lisp machines. The software has three goals, to determine preferences for using natural language terms for representing uncertainty; likelihood rankings of the terms; and how likelihood estimates are combined to form new terms. The first two goals relate to providing useful results for those interested in risk communication. The third relates to providing cognitive data to further our understanding of people's decision making under uncertainty. The software is used to elicit natural language terms used to express the likelihood of various agents causing cancer in humans and cancer resulting in various maladies, and the likelihood of everyday events. 6 refs., 4 figs., 4 tabs.

1988 (LA-UR–89-2607) **Vectorization of Monte Carlo particle transport: An architectural study using the LANL benchmark "GAMTEB".** Burns, P.J.; Christon, M.; Schweitzer, R.; Lubeck, O.M.; Wasserman, H.J.; Simmons, M.L.; Pryor, D.V. Los Alamos National Lab., NM (USA). [1989]. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891149–5: Supercomputing '89 conference, Reno, NV (USA), 13-17 Nov 1989). Order Number DE89016607. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fully vectorized versions of the Los Alamos National Laboratory benchmark code Gamteb, a Monte Carlo photon transport algorithm, were developed for the Cyber 205/ETA-10 and Cray X-MP/Y-MP architectures. Single-processor performance measurements of the vector and scalar implementations were modeled in a modified Amdahl's Law that accounts for additional data motion in the vector code. The performance and implementation strategy of the vector codes are related to architectural features of each machine. Speedups between fifteen and eighteen for Cyber 205/ETA-10 architectures, and about nine for CRAY X-MP/Y-MP architectures are observed. The best single processor execution time for the problem was 0.33 seconds on the ETA-10G, and 0.42 seconds on the CRAY Y-MP. 32 refs., 12 figs., 1 tab.

1989 (LBL–27821) **Macrotasking the singular value decomposition of block circulant matrices on the Cray-2.** Baker, J.R. Lawrence Berkeley Lab., CA (USA). Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891149–9: Supercomputing '89 conference, Reno, NV (USA), 13-17 Nov 1989). Order Number DE90002333. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A parallel algorithm to compute the singular value decomposition (SVD) of block circulant matrices on the Cray-2 is described. For a block circulant form described by M blocks with m x n elements in each block, the computation time using an SVD algorithm for general matrices has a lower bound $\Omega(M^3 \min(m,n)mn)$. Using a combination of fast Fourier transform (FFT) and SVD steps, the computation time for block circulant singular value decomposition (BCSVD) has a lower bound $\Omega(M \min(m,n)mn)$; a relative savings of $\sim M^2$. Memory usage bounds are reduced from $\Theta(M^2mn)$ to $\Theta(Mmn)$; a relative savings of $\sim M$. For M = m = n = 64, this decreases the computation time from approximately 12 hours to 30 seconds and memory usage is reduced from 768 megabytes to 12 megabytes. The BCSVD algorithm partitions well into n macrotasks with a granularity of $\Theta(mM \log M)$ for the FFT portion of the algorithm. The SVD portion of the algorithm partitions into M macrotasks with a granularity of $\Omega(\min(m,n)mn)$. Again, for the case where M = m = n = 64, the FFT granularity is 29ms and the SVD granularity is 428ms. A speedup of 3.06 was achieved by using a prescheduled partitioning of tasks. The process creation overhead was 2.63ms. Using a more elaborate self-scheduling method with four synchronizing server processes, a speedup of 3.25 was observed with four processors available. The server synchronization overhead was 0.32ms. Relative memory overhead in both cases was about 4% for data space and 40% for code space. 16 refs., 3 figs., 3 tabs.

1990 (N–89-26454, pp. 273-282) **The 3-D world modeling with updating capability based on combinatorial geometry.** Goldstein, M.; Pin, F.G.; Desaussure, G.; Weisbin, C.R. Oak Ridge

National Lab., TN (USA). Jul 1987. (NASA-CR–184685;JPL-PUBL–87-13-VOL-1;NAS–1.26:184685;CONF-870134–; Workshop on space telerobotics, Pasadena, CA (USA), 20-22 Jan 1987). In *Proceedings of the Workshop on Space Telerobotics, volume 1.* Available from NTIS, PC A16/MF A01.

A 3-D world modeling technique using range data is discribed. Range data quantify the distances from the sensor focal plane to the object surface, i.e., the 3-D coordinates of discrete points on the object surface are known. The approach proposed herein for 3-D world modeling is based on the Combinatorial Geometry (CG) method which is widely used in Monte Carlo particle transport calculations. First, each measured point on the object surface is surrounded by a small sphere with a radius determined by the range to that point. Then, the 3-D shapes of the visible surfaces are obtained by taking the (Boolean) union of all the spheres. The result is an unambiguous representation of the object's boundary surfaces. The pre-learned partial knowledge of the environment can be also represented using the CG Method with a relatively small amount of data. Using the CG type of representation, distances in desired directions to boundary surfaces of various objects are efficiently calculated. This feature is particularly useful for continuously verifying the world model against the data provided by a range finder, and for integrating range data from successive locations of the robot during motion. The efficiency of the proposed approach is illustrated by simulations of a spherical robot in a 3-D room in the presence of moving obstacles and inadequate prelearned partial knowledge of the environment.

1991 (ORNL/FTR–3406) **[French technological progress in the field of robotics and teleoperation]: Foreign trip report, September 9,1989–September 30, 1989.** Richardson, B.S. Oak Ridge National Lab., TN (USA). 16 Oct 1989. 17p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90001590. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A survey of robotics research activity in France was performed for the US Army to obtain a broad perspective on French robotics activities and to identify topics for possible US/French cooperation. French government and industrial laboratories were visited in the Paris area, Grenoble, Toulon, and Toulouse. The team was very well received, and there was significant interest in setting up meaningful collaboration. The French have a significant ongoing effort in mobile robotics and, through several joint European research programs, are in the process of increasing this effort. The facilities and resources committed to mobile robotics research were impressive. There is a significant amount of cooperation among government agencies, industry, and universities. Areas for possible collaboration were agreed upon as well as a follow-up visit to the US by the French and a possible exchange of engineers. The details of the collaboration will be addressed following issuance of the Army report summarizing the visit to France.

1992 (PB–89-212435/XAB) **Brief walk through KAOS (Kent Applicative Operating System).** Cupitt, J. Kent Univ., Canterbury (UK). Computing Lab. Feb 1989. 29p. (UKC/COMPUTING-LAB–58). Available from NTIS, PC EE05/MF E05.

There have been several attempts to implement operating systems in functional languages. In a previous report a simple technique for modeling parallel processes in functional languages was presented. This report describes KAOS (Kent Applicative Operating System), a small multi-user operating system implemented using this process model. The first section describes the ways in which the real KAOS kernel expands upon the kernel in the previous report. The second section describes all the messages understood by the KAOS system processes in detail. The third section covers the libraries available to user level processes to hide all the details mentioned in the previous section. A short fourth section outlines the facilities provided by the KAOS shell and the programs available that run under it. The final section is an extended discussion of the areas in which KAOS still has problems.

1993 (PB–89-869085/XAB) **Computers: Massively parallel processors. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 66p. Available from NTISPC N01/MF N01.

Supersedes PB–86-866480.

This bibliography contains citations concerning massively parallel processors. The processing power of a computer may be increased by using numerous processors in parallel and feeding data through a number of different computational paths at the same time. These computers are now in practical use and are discussed in detail including case studies, specific problems solved, theory, and future possibilities and needs. (This updated bibliography contains 101 citations, 50 of which are new entries to the previous edition.)

1994 (PB–89-869523/XAB) **Parallel processors. September 1987-August 1989 (Citations from the COMPENDEX data base). Report for September 1987-August 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 140p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867650.

This bibliography contains citations concerning research on the design, development, and application of parallel processors. Studies include the development of numerical techniques for parallel processing, scheduling parallel processors, and parallel processing of various types of scientific data. The development of algorithms and computer programs is presented. Specific studies on Illiac computers are considered. (This updated bibliography contains 297 citations, 159 of which are new entries to the previous edition.)

1995 (SAND–89-1442C) **Generalization in backpropagation networks: An empirical study using image data.** Moya, M.M.; Fogler, R.J.; Hostetler, L.D. Sandia National Labs., Albuquerque, NM (USA). [1989]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891150–1: IEEE conference on neutral information processing systems, Denver, CO (USA), 27-30 Nov 1989). Order Number DE89012658. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we report the ability of trained multi-layer, first-order feedforward networks to generalize the perspective-invariant classification of image data. We introduce the method of interactive training which is useful when specific types of non-target images are important in the classification. Within interactive training, we show that the network can recognize perspective-independent images of one object and reject perspective-independent images of other objects in its training set, as well as reject a significant number of images of other objects on which it was not trained. However, the first-order network is still not capable of reliable one-class generalization. Therefore, we introduce a method for training a network with images on the boundary of the target class for one-class generalization. We report on the generalization ability of a second-order network trained with this method. We also describe the implementation of the feedforward network in a fixed-point hardware implementation that can process images at more than a billion connections per second. 16 refs., 9 figs.

1996 (SAND–89-2440C) **How to successfully move data between a personnel mainframe HRIS and the REGISTRAR.** McClaflin, R.S. Sandia National Labs., Albuquerque, NM (USA). [1989]. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891199–1: 3. Silton-Bookman Systems annual user's conference, San Francisco, CA (USA), 13 Nov 1989). Order Number DE90000787. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This presentation is a case study of the system that was developed to move data between our mainframe HRIS and the REGISTRAR. It not only contains a description of the system itself but of the factors that come into play in deciding whether to implement a system at all and in deciding what kind of system to implement.

1997 (UCRL–100735) **Wafer scale RISC [Reduced Instruction Set Computer] processor.** Kaschmitter, J.; Scott, W.; Rubarth, F.; Capots, L. Lawrence Livermore National Lab., CA (USA). Nov 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891159–3: GOMAC '89: government microcircuit applications conference, Orlando, FL (USA), 7-9 Nov 1989). Order Number DE90001680. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lawrence Livermore National Laboratory (LLNL), working with Fairchild Space Co. (FSC), is developing a lightweight, high reliability Hybrid Wafer Scale Integration (HWSI) computer under funding provided by SDIO, VHSIC and the US Navy. This Reduced Instruction Set Computer (RISC) incorporates multiple processors communicating over a high speed bus. Since July, 1987, development has proceeded through conception, design, simulation, prototype and brassboard demonstration. Software development has proceeded in parallel with hardware integration, using prototype boards operating at reduced clock rates. This paper discusses this processor. 4 refs., 3 figs.

1998 (UCRL–101437) **Using object-oriented development to support prototyping.** Zucconi, L.; Mack, G.; Williams, L.G. Lawrence Livermore National Lab., CA (USA). Sep 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. (CONF-8909240–1: ICSF12: 12th international conference on software engineering, Nice (France), Sep 1989). Order Number DE90000547. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Prototyping can be a valuable tool in software development, particularly in cases where the requirements are uncertain or where there is a significant amount of risk associated with the implementation [Boeh84], [Boeh88]. The use of prototyping can, however, lead to several problems. These include: a less coherent design than would be obtained with a specification-based approach, poor (or nonexistent) documentation, and a tendency to deliver the prototype as the finished product as schedule pressures mount. This report describes a project in which more formal software development methods were used in parallel with a prototyping effort to develop a real-time monitor and control computer system. The prototype was used to define and clarify the requirements for the system. The more formal approach was used to capture and document those requirements. The resulting description of the system was then used to capture and document those requirements. The resulting description of the system was then used to migrate the prototype to a first version production system. This combined approach helped to overcome many of the problems typically associated with prototyping alone. 9 refs.

1999 **Highly concurrent dynamic simulation in chemical engineering.** Skjellum, A.; Morari, M.; Mattisson, S.; Peterson, L. 30p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 175D.

Cost-effective, high-speed computing is essential in chemical engineering, notably for large-scale, dynamic simulation and optimization. New, powerful, highly concurrent, distributed-memory multicomputers offer this potential. The authors explore the easy, difficult, available and exploitable concurrency inherent in a number of chemical engineering systems such as distillation and a fixed-bed reactor. They distinguish between concurrency in the integration process and that available in model evaluation. They offer an analysis of potential speedup and compare qualitatively to 'modular' approaches. Implementation aspects and speedup results obtained thus far on actual hardware systems are indicated.

2000 **1000-fold speedup of scientific computations on a 1024 processor hypercube.** Benner, R.E. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 173A.

Sandia scientists have developed highly parallel algorithms to solve complex problems at unprecedented speedups. This work will: describe the methods and algorithms used to achieve the unprecedented speedup levels; discuss techniques for minimizing and quantifying redundant computation, communications, and serial overhead as a function of problem size and number of processors; and discuss both algorithmic and hardware roadblocks to high efficiency at high levels of parallelism.

2001 **An OPS5-english english-OPS5 parser and language generator.** Baird, B. (Connecticut College, New London, CT (US)); Wertheimer, S.; Gove, N.; Otaduy, P. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

This work translates OPS5 productions to and from English and other languages. The translation process does not go directly from source language (either OPS5 or English) to the target language; there is a collection of intermediate structures which contain all of the information contained in the original OPS5 production and which also makes the translation job easier. Parsing and translation are done using the programming language Prolog; this choice was made because of its powerful parsing capabilities. The authors have developed these for OPS83 (a programming language which is more general than OPS5), French, German and several other styles of English. The different English style translations are meant for different end users, such as OPS5 programmers, or those with some programming background but no knowledge of OPS5.

2002 **The construction of preconditioners for elliptic problems by substructuring, IV.** Bramble, J.H.; Pasciak, J.E.; Schatz, A.H. *Mathematics of Computation (USA),* 53(187): 1-24 (Jul 1989).

We consider the problem of solving the algebraic system of equations which result from the discretization of elliptic boundary value problems defined on three-dimensional Euclidean space. We develop preconditioners for such systems based on substructuring (also known as domain decomposition). The resulting algorithms are well suited to emerging parallel computing architectures. We describe two techniques for developing these preconditioners. A theory for the analysis of the condition number for the resulting preconditioned system is given and the results of supporting numerical experiments are presented.

2003 **Numerical solution of some classical differential-difference equations.** Marsaglia, G.; Zaman, A.; Marsaglia, J.C.W. *Mathematics of Computation (USA),* 53(187): 191-201 (Jul 1989).

For differential-difference equations, we provide a method that gives numerical solutions accurate to hundreds or even thousands of digits. We illustrate with numerical solutions to three classical problems. With a few exceptions, previous claims of extended accuracy for these problems are found to be wrong.

2004 **A table of elliptic integrals: Cubic cases.** Carlson, B.C. *Mathematics of Computation (USA),* 53(187): 327-333 (Jul 1989).

Forty-one integrands that are rational except for the square root of a cubic polynomial with known real zeros are integrated in terms of *R*-functions for which Fortran codes are available. In cotrast tc conventional tables the interval of integration is not required to begin or end at a singular point of the integrand. The table contains one elliptic integral of the first kind, 26 of the second kind, and 14 of the third kind. Only 10 of the integrals are treated in standard tables, which list a large number of special cases that are unified here.

2005 **Large-scale problems and supercomputing in the Department of Energy.** Decker, J.F. (Department of Energy, Washington, DC (USA). Office of Energy Research); Nelson, D.B.; Austin, D.M. *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(7): 1020-1037 (Jul 1989).

The Department of Energy (DOE) has been a pioneer in the development and use of supercomputers. Today, large-scale scientific computations are an essential part of most of the DOE R&D programs. Examples of important DOE supercomputer applications are given, including energy systems design, weapons systems design, and basic research. Computational techniques used in these applications are discussed, along with results and outstanding problems. The department's approach to providing supercomputer resources to its researchers is outlined, including descriptions of the supercomputer resources available to various programs. In addition, the DOE research programs in parallel architectures, algorithms, and mathematical methods are discussed.

2006 **Computational approaches to discovering semantics in molecular biology.** Lipton, R.J. (Princeton Univ., NJ (USA));

Marr, T.G.; Welsh, J.D. *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (USA),* 77(7): 1056-1060 (Jul 1989).

One of the central questions of molecular biology is the discovery of the semantics of DNA. This discovery relies in a critical way on a variety of expensive computations. In order to solve these computations, both parallel computers and special-purpose hardware play a major role.

2007 **Token relabeling in a tagged token data-flow architecture.** Gaudiot, J.L. (University of Southern California, Los Angeles, CA (USA). Dept. of Electrical Engineering); Wei, Y.H. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Computers (USA),* 38(9): 1225-1239 (Sep 1989).

Data-flow principles of execution offer an efficient way of scheduling operations in large-scale distributed multicomputer systems. large data structures are, however, a notorious difficulty and require special handling. The indirect structure access made through a structure memory (e.g., I-structures) has been adopted in some proposed data-flow machines. In this paper, the authors present a direct structure access approach (the token relabeling scheme) in which all array operations can be performed without the use of any intermediary structure memory. The graph constructs for both approaches are described. Four numerical algorithms including fast Fourier transform, bitonic sort, LU decomposition, and matrix multiplication have been implemented in both approaches. Token relabeling is directly applicable to arrays which are entirely consumed. They have also designed graph constructs which allow partial consumption. It is shown how the direct access graphs present better performance with regard to execution time, speedup, and resource utilization.

2008 **Utilizing multidimensional loop parallelism on large-scale parallel processor systems.** Polychronopoulos, C.D. (Illinois Univ., Urbana, IL (USA). Center for Supercomputing Research and Development); Kuck, D.J.; Padua, D.A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Computers (USA),* 38(9): 1285-1296 (Sep 1989).

Parallel processor systems that have been built so far can execute in parallel only singly nested parallel loops. However, it is crucial to be able to exploit multidimensional parallelism which occurs in multiply nested parallel loops. Developing schemes for executing efficiently arbitrarily nested loops in parallel will allow us to exploit (and therefore develop) computer systems with hundreds or thousands of processors. In this paper, the authors discuss issues on program parallelism and processor allocation for parallel processor systems. Optimal processor assignment algorithms are presented for simple and complex nested parallel loops. These processor assignment schemes can be used by the compiler to perform static processor allocation to multiply nested parallel loops. Speedup measurements for EISPACK and IEEE DSP subroutines that result from the optimal assignment of processors to parallel loops are also presented.

2009 **Real-time applications of neural nets.** Spencer, J.E. (Stanford Univ., CA (USA)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1485-1489 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Producing, accelerating and colliding very high power, low emittance beams for long periods is a formidable problem in real-time control. As energy has grown exponentially in time so has the complexity of the machines and their control systems. Similar growth rates have occurred in many areas e.g. improved integrated circuits have been paid for with comparable increases in complexity. However, in this case, reliability, capability and cost have improved due to reduced size, high production and increased integration which allow various kinds of feedback. In contrast, most large complex systems (LCS) are perceived to lack such possibilities because only one copy is made. Neural nets, as a metaphor for LCS, suggest ways to circumvent such limitations. It is argued that they are logically equivalent to multi-loop feedback/forward control of faulty systems. While complimentary to AI, they mesh nicely with characteristics desired for real-time systems. In this paper, such issues are considered, examples given and possibilities discussed.

2010 **Remote procedure execution software for distributed systems.** Petravick, D.L. (Fermi National Accelerator Lab., Batavia, IL (USA)); Berman, E.F.; Sergey, G.P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(5): 1706-1709 (Oct 1989). (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989).

Remote Procedure Execution facilitates the construction of distributed software systems, spanning computers of various types. Programmers who use the RPX package specify subroutine calls which are to be executed on a remote computer. RPX is used to generate code for dummy routines which transmit input parameters and receive output parameters, as well as a main program which receives procedure call requests, calls the requested procedure, and returns the result. The package automatically performs datatype conversions and uses an appropriate connection oriented protocol.

9903 Information Handling

Refer also to citation(s) 339, 1289, 1352, 1980

2011 (CONF-8909188–1) **Reports management.** Langford, J.L. Oak Ridge National Lab., TN (USA). 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-8910205–1: Knoxville - East Tennessee Chapter of the ARMA seminar; 34. annual ARMA international conference: building bridges of professionalism; Knoxville - East Tennessee Chapter of ARMA meeting, Alcoa, TN (USA); New Orleans, LA (USA); Knoxville, Order Number DE89016039. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Effective reports management in any organization, particularly a large and diverse one, is a necessary part of a comprehensive Records Management Program. This session discusses reports management from the viewpoint of a government agency research and development contractor whose primary "product" is information in the form of scientific and technical reports, open-literature publications, and oral presentations. However, many of the principles related to managing large numbers of reports can also be applied to the private sector. 6 figs.

9905 Civilian Defense

Refer also to citation(s) 1363

2012 (AD-A–209777/2/XAB) **SDI (Strategic Defense Initiative): Shield or sword. Study Project.** Butler, C.S.; Spiczak, G.R. Army War Coll., Carlisle Barracks, PA (USA). 15 May 1989. 37p. Available from NTIS, PC A03/MF A01.

The paper attempts to answer the fundamental question, is SDI an adjunct to a first strike strategy. As its criteria, it discusses Soviet and U.S. opposing views on SDI, an historical application of Mutual Assured Destruction strategy, and a discussion of Soviet and U.S. thinking on first-strike capability. President Reagan's March 1983 address on SDI is used as the backdrop to set the stage for the discussion. It is the objective of the authors to evaluate and analyze the potential impact of SDI on first strike.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

A

Acres International Corp., Amherst, NY (USA)
Report on siphon penstocks for hydroelectric projects: Small-Scale Hydroelectric Power, 15:235 (R;US)

Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France)
Validation of Computational Fluid Dynamics. Volume 1. Symposium papers and round table discussion, 15:1048 (R;FR;In several languages)
Validation of Computational Fluid Dynamics. Volume 2: Poster papers, 15:1049 (R;FR)

Aerospace Corp., El Segundo, CA (USA)
Raman and RBS studies of ion implanted semiconductors, 15:869 (R;US)

Agricultural Research Service, Raleigh, NC (USA)
Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)

Air Force Astronautics Lab., Edwards AFB, CA (USA)
Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989, 15:1887 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)

Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)
Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
Hazardous-waste technical-assistance survey, Carswell AFB, Texas. Final report, 16-27 May 1988, 15:730 (R;US)
Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)

Air Force Operational Test and Evaluation Center, Kirtland AFB, NM (USA)
Introduction to the operational nuclear-survivability assessment process. Technical paper, 15:1226 (R;US)

Alabama Cryogenic Engineering, Inc., Huntsville, AL (USA)
Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989, 15:984 (R;US)

Alabama Univ., Huntsville, AL (USA)
SRB combustion dynamics analysis computer program (CDA-2). Final report, 15:973 (R;US)

Alabama Univ., University, AL (USA). School of Mines and Energy Development
Beneficiation-hydroretort processing of US oil shales: Volume 2: Final report, 15:105 (R;US)
Beneficiation-hydroretort processing of US oil shales, engineering study: Volume 3, Final report, 15:106 (R;US)

Alaska Univ., Fairbanks, AK (USA). Inst. of Northern Engineering
Alaskan Commodities Irradiation Project: An options analysis study, 15:1415 (R;US)
[Alaskan commodities irradiation project: An options analysis study]: Final technical report, 15:1414 (R;US)

Alfred Univ., NY (USA)
Preparation and evaluation of silicon nitride matrices for silicon nitride-SiC fiber composites. M.S. Thesis Final Technical Report, 15:830 (R;US)

Alliance Technologies Corp., Bedford, MA (USA)
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)

Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center
Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)
Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988, 15:3 (R;US)

American Coll. of Radiology, Chicago, IL (USA)
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)

American Council for an Energy-Efficient Economy, Washington, DC (USA)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Index volume, Subject and author index, 15:676 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 1, Single-family building technologies, 15:677 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 10, Performance measurement and analysis, 15:683 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 11, Behavior and lifestyle, 15:635 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 2, Multifamily building technologies, 15:678 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 3, Commercial and industrial building technologies, 15:633 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 4, Appliances and equipment, 15:679 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 5, National and regional conservation programs, 15:634 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 6, Utility and private sector conservation programs, 15:680 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 8, Planning and forecasting, 15:681 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 9, Program evaluation, 15:682 (R;US)

American Management Systems, Inc., Arlington, VA (USA)
EPA (Environmental Protection Agency) workshop to recommend a minimum set of data elements for ground water: workshop findings report, 15:1352 (R;US)

American Paper Inst., Inc., New York, NY (USA)
Kraft recovery boiler physical and chemical processes, 15:699 (B;US)

American Type Culture Collection, Rockville, MD (USA)
Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)

Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.
Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989, 15:2 (R;US)
Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)
Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)

Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)
Environmental and climate research programme 1988/89, 15:1236 (R;DE;In German)

Architectural Energy Corp., Boulder, CO (USA)
Post-construction activities; Passive and hybrid solar low energy buildings: Design information booklet number eight, 15:685 (R;US)

Argonne National Lab., Idaho Falls, ID (USA)
Improvements in fabrication of metallic fuels, 15:113 (R;US)

Argonne National Lab., IL (USA)
A block QR factorization algorithm using restricted pivoting, 15:1984 (R;US)
A comparative analysis of alternative fuel infrastructure requirements, 15:745 (R;US)
A graphics tool to aid in the generation of parallel FORTRAN programs, 15:1986 (R;US)
A model for the future: Innovative combination of technologies for soil and groudwater VOC [volatile organic compound] remediation, 15:1327 (R;US)
A new balance-of-plant model for the SASSYS-1 LMR systems analysis code, 15:391 (R;US)
A proposed method of measuring the electric-dipole moment of the neutron by ultracold neutron interferometry, 15:1779 (R;US)
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
Accelerated aging embrittlement of cast duplex stainless steel: Activation energy for extrapolation, 15:763 (R;US)
An improved steam generator model for the SASSYS code, 15:393 (R;US)
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Analysis and comparison of two Victorian Brown Coal resinite samples, 15:18 (R;US)
Analytical electron microscopy of leached nuclear waste glasses, 15:139 (R;US)
Application of supported liquid membranes for removal of uranium from groundwater, 15:1345 (R;US)
Approximate methods for dynamic plastic deformation of structures, 15:766 (R;US)
Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)
Assessment of the importance of acidic fogwater and cloudwater in affecting terrestrial vegetation: Some important case studies, 15:1256 (R;US)
Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)
Biofouling and corrosion research for marine heat exchangers, 15:279 (R;US)
$CeRu_2Si_2$ and URu_2Si_2: Same or different?, 15:870 (R;US)
Charge transfer and bond lengths in $YBa_2Cu_{3-x}M_xO_{6+y}$, 15:1869 (R;US)
Chemical structures in eight US premium coals: The nature of the heteroatoms, 15:19 (R;US)
Comparison of structural subunits of the core light-harvesting complexes of photosynthetic bacteria, 15:241 (R;US)
Confinement and the Pomeron, 15:1731 (R;US)
Conversion and standardization of US university reactor fuels using LEU, status 1989, 15:475 (R;US)
Correlation of interface structure with adhesive strength of ion-plated TiN hard coatings, 15:820 (R;US)
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)
Emittance growth in a storage ring due to ground motion, 15:1143 (R;US)
Evaluation of VOC (volatile organic compound) emissions from landfarming operations, 15:1254 (R;US)
Getting maximum information from incomplete data on B → charmonium-K_S decays, 15:1721 (R;US)
Hamiltonian flows, Su(∞), SO(∞), USp(∞), and strings, 15:1762 (R;US)
Hazardous waste research and development in the Pacific Basin, 15:1297 (R;US)
Identification of secondary phases formed during unsaturated reaction of UO_2 with EJ-13 water, 15:958 (R;US)
Identification of the heteroatom containing compounds in the benzene/methanol extracts of the Argonne Premium Coal Samples, 15:17 (R;US)
Impedance calculations for 2-D and 3-D structures and the impedance budget of 7-GeV APS [Advanced Photon Source] storage ring, 15:1142 (R;US)
Improved performance of low-Tc superconductors for detection of minimum-ionizing particles, 15:1161 (R;US)
Irradiation performance of metallic fuels, 15:392 (R;US)
Jets, W's, and Z's at $\sqrt{s}$ = 1.8 TeV, 15:1720 (R;US)
$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)
Laser-induced flourescence studies of Cm^{3+} complexes in solution, 15:873 (R;US)
Magnetic and electrical properties, 15:762 (R;US)
Magnetotransport studies of epitaxial Cr thin films, 15:764 (R;US)
Measurement of long-lived isotopes and helium production in fusion materials, 15:1922 (R;US)
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Nucleation and growth mechanisms in ion-plated TiN films on steel substrates, 15:819 (R;US)
Operating experience with the Argonne PIIECR ion source system, 15:1112 (R;US)
Operational experience of the ATLAS accelerator, 15:1090 (R;US)
Parametric effects of glass reaction under unsaturated conditions, 15:872 (R;US)
Phenomenology of heavy quark production, 15:1732 (R;US)
Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system, 15:821 (R;US)
Proceedings of the seventh symposium on energy engineering sciences: Nonlinear mechanics and mechanical systems, 15:1051 (R;US)
Reflection asymmetric shapes in nuclei, 15:1799 (R;US)
Siting industrial waste land disposal facilities in Thailand: A risk based approach, 15:1317 (R;US)
SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)
Status of magnet power supply development for the APS [Advanced Photon Source] storage ring, 15:1144 (R;US)
Status of RF superconductivity at Argonne, 15:1115 (R;US)
Status of superconducting rf cavity development, 15:1111 (R;US)
Status report on the radio frequency accelerating system of the APS [Advanced Photon Source] at Argonne, 15:1110 (R;US)
Structural studies at high pressure using time-of-flight neutron powder diffraction, 15:1828 (R;US)
Structure and dynamics of disordered systems, 15:1829 (R;US)
Study of collective effects in a low-emittance PEP lattice, 15:1141 (R;US)
The τ one-prong problem and recent measurements by the HRS [High Resolution Spectrometer] collaboration, 15:1719 (R;US)
The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater, 15:138 (R;US)
The positron accumulator ring for the APS, 15:1145 (R;US)
The shell model approach: Key to hadron structure?, 15:1730 (R;US)
The soudan 2 experiment, 15:1153 (R;US)
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)

Theory of the energetics and nonclassical nucleation for martensitic transformations from partially soft lattice modes, 15:767 (R;US)
Three-dimensional bowing analysis of radial reflector assemblies in advanced LMRS, 15:390 (R;US)
Vacuum chamber thermal protection for the APS [Advanced Photon Source], 15:1109 (R;US)

Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)

Army Materiel Command, New Cumberland, PA (USA). Catalog Data Activity
Hazardous Materiel Data File (HMDF), quarterly update. Data file, 15:619 (R;US)

Army Strategic Defense Command, Huntsville, AL (USA)
Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll, 15:1363 (R;US)

Army War Coll., Carlisle Barracks, PA (USA)
Force structure implications of START. Study project, 15:749 (R;US)
SDI (Strategic Defense Initiative): Shield or sword. Study Project, 15:2012 (R;US)
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
Soviet strategic nuclear doctrine under Gorbachev. Study project, 15:1225 (R;US)
United States military strategy in the Persian Gulf. Study project, 15:45 (R;US)

Associacao Brasileira de Metais, Sao Paulo, SP (Brazil)
Chemical analysis by X-ray fluorescence, of niobium in high-strength plate steels, 15:927 (R;BR;In Portuguese)

Atkins (W.S.) and Partners, Epsom (UK)
Copper vapour heat recovery using a spiral heat exchanger. A demonstration at Alloa Brewery Co., 15:708 (R;GB)
Heat recovery and energy saving using a Baker Perkins Simplex 2000 bread baking oven. A demonstration at Mothers Pride Bakery. [Nottingham], 15:704 (R;GB)

B

Babcock and Wilcox Co., Alliance, OH (USA)
Western New York State coal-water fuel market and boiler-conversion study. Final report, 15:32 (R;US)

Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Babcock and Wilcox Co., Lynchburg, VA (USA)
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)

Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Babcock and Wilcox Owners Group, Lynchburg, VA (USA)
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Bartlett Technologies, Idaho Falls, ID (USA)
Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)

Battelle Columbus Div., OH (USA)
Assessment of technology for self-powered gas appliances: A GATC (Gas Appliance Technology Center) task report, July 1988-January 1989, 15:103 (R;US)
Briefing report to the EPA (Environmental Protection Agency) Science Advisory Board: The apparent effects threshold approach. Briefing report (Final), 15:1335 (R;US)

Battelle Columbus Labs., OH (USA)
A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)

Battelle Pacific Northwest Lab., Richland, WA (USA)
Analysis of samples from the Purex vessel vent silver reactor, 15:134 (R;US)
Some observations concerning the chemistry of the Purex vessel vent silver reactor, 15:135 (R;US)

Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)
Experimental investigations of the sensitivity of hydrogen-steam-air mixtures with regard to the deflagration-detonation transition, 15:481 (R;DE;In German)
Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report, 15:1419 (R;DE;In German)

BDM Corp., Austin, TX (USA)
Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988, 15:101 (R;US)

Bergakademie, Freiberg (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Biomass Energy Service Team, Falmouth, ME (USA)
Directory of biomass energy facilities in the northeast, 15:244 (R;US)

BNF Metals Technology Centre, Wantage (UK)
Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds, 15:707 (R;GB)

Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet
Comparison between photo- and hadroproduction of rho^0 mesons at the CERN-OMEGA spectrometer, 15:1723 (R;DE;In German)
Development and construction of a monitoring system for the central drift chamber of the SAPHIR detector, 15:1155 (R;DE;In German)
Development of the software of the data taking system SOS for the SAPHIR experiment, 15:1981 (R;DE;In German)
Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR, 15:1156 (R;DE;In German)
Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring, 15:1158 (R;DE;In German)
Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
Studies on the hard scattering in photon-proton reactions in the energy range from 65 to 175 GeV at the CERN Ω spectrometer, 15:1722 (R;DE;In German)
The injection system of the stretcher ring ELSA, 15:1108 (R;DE;In German)
Track recognition and track reconstruction in the forward drift chamber of SAPHIR, 15:1159 (R;DE;In German)
Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)

Bonn Univ. (Germany, F.R.). Physikalisches Inst.
Comparison between photo- and hadroproduction of rho^0 mesons at the CERN-OMEGA spectrometer, 15:1723 (R;DE;In German)
Development and construction of a monitoring system for the central drift chamber of the SAPHIR detector, 15:1155 (R;DE;In German)
Development of the software of the data taking system SOS for the SAPHIR experiment, 15:1981 (R;DE;In German)
Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR, 15:1156 (R;DE;In German)
Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring, 15:1158 (R;DE;In German)
Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
Studies on the hard scattering in photon-proton reactions in the energy range from 65 to 175 GeV at the CERN Ω spectrometer, 15:1722 (R;DE;In German)

The injection system of the stretcher ring ELSA, 15:1108 (R;DE;In German)
Track recognition and track reconstruction in the forward drift chamber of SAPHIR, 15:1159 (R;DE;In German)
Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)

Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires
Angular momentum distributions of autoionizing states produced in 1.5 MeV C^{q+} + C_{foil} and C^{q+} + He collisions, 15:1785 (R;FR)

Brigham Young Univ., Provo, UT (USA)
Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988–December 15, 1988, 15:6 (R;US)

Brigham Young Univ., Provo, UT (USA). Combustion Lab.
Oxidation and explosive limits of low-rank coal, Volume 1: Final report, 15:20 (R;US)

British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility
KAON physics, 15:1097 (R;CA)

British Geological Survey, Keyworth (UK)
United Kingdom Minerals Tearbook, 1988. Statistical data to 1987, 15:621 (R;GB)

British Steel Corp., Rotherham (UK). Swinden Labs.
Foundry ladle preheater of improved design. A demonstration at North British Steel Group Ltd. [Bathgate], 15:714 (R;GB)

Brookhaven National Lab., Upton, NY (USA)
Biotechnology at Brookhaven National Laboratory, 15:1366 (R;US)
CP violation in $K_L \rightarrow \pi^0 e^+ e^-$, 15:1733 (R;US)
Economical disposal of municipal solid waste with minimal discharges to the atmosphere and maximum recycling of energy and metal values, 15:731 (R;US)
Exchange coupling in metals as understood then and now, 15:760 (R;US)
Medium energy charged particle data for evaluation, 15:1774 (R;US)
Neutron scattering studies of magnetic correlations in the layered cuprates, 15:1868 (R;US)
Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)
Performance of a directly water-cooled silicon crystal for use in high-power synchrotron radiation applications, 15:1105 (R;US)
Rf stability, control and bunch lengthening in electron synchrotron storage rings, 15:1101 (R;US)
Soft x-ray microscope using Fourier transform holography, 15:1107 (R;US)
Synchrotron radiation as a tool for study of biological structure, 15:1395 (R;US)
The uses of synchrotron radiation sources for elemental and chemical microanalysis, 15:1212 (R;US)
X-ray lithography source (SXLS) vacuum system, 15:1106 (R;US)
[Advanced acceleration]: Foreign trip report, August 16–26, 1989, 15:1120 (R;US)
[Biological applications of synchrotron radiation]: Foreign trip report, August 13–19, 1989, 15:1427 (R;US)
[Bioproductivity and photosynthesis]: Foreign trip report, September 21–30, 1989, 15:243 (R;US)
[Brief highlights of the Eleventh international vacuum congress]: Foreign trip report, September 23–30, 1989, 15:937 (R;US)
[Development of risk-based safety indicators]: Foreign trip report, July 1, 1989–July 9, 1989, 15:486 (R;US)
[High energy accelerators]: Foreign trip report, August 19, 1989–August 31, 1989, 15:1092 (R;US)
[Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989, 15:769 (R;US)
[Production and use of energy from nuclear reactions]: Foreign trip report, July 2–8, 1989, 15:334 (R;US)
[Production of coils for magnets of European colliders]: Foreign trip report, September 25, 1989–September 27, 1989, 15:1119 (R;US)
[Progresses and status of the AGS booster project]: Foreign trip report, August 9, 1989–August 27, 1989, 15:1093 (R;US)
[Research on the structure of the adenovirus virion]: Foreign trip report, July 9–August 1, 1989, 15:1372 (R;US)
[Shipment of Booster Dipole Vacuum Chambers]: Foreign trip report, August 28, 1989–September 10, 1989, 15:1121 (R;US)
[Superconducting magnet test facilities at CERN [European Organization for Nuclear Research] and modifications to the cryogenic system for the AGS Experiment 840]: Foreign trip report, September 21, 1989–September 24, 1989, 15:1117 (R;US)
[Testing superconducting magnets for the HERA project]: Foreign trip report, September 16–September 24, 1989, 15:1118 (R;US)
[The AGS Booster Vacuum Systems]: Foreign trip report, September 23, 1989–October 4, 1989, 15:1116 (R;US)
[The hematopoietic stem cell]: Foreign trip report, September 27–October 11, 1989, 15:1389 (R;US)
[The safety of present and future nuclear power plants]: Foreign trip report, September 23, 1989–October 8, 1989, 15:1838 (R;US)
[The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989, 15:959 (R;US)

Building Research Establishment, Watford (UK)
Domestic warm-air heating systems using low-grade heat sources, 15:673 (R;GB)
Energy efficiency in the housing stock, 15:675 (R;GB)
Thermal performance of lightweight inverted warm deck flat roofs, 15:674 (R;GB)

Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.)
Comparative analysis of tritium in water, 1987, 15:1344 (R;DE;In German)

Bundesministerium der Verteidigung, Bonn (Germany, F.R.)
Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report, 15:1419 (R;DE;In German)
Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report, 15:1421 (R;DE;In German)
Investigations on human blood cells for the diagnosis of radiation damage. Final report, 15:1420 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Baryon-baryon interaction and dibaryonic systems. Review and perspectives, 15:1725 (R;DE)
Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress, 15:772 (R;DE;In German)
PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report, 15:354 (R;DE;In German)
Pulsed TIG welding of pipes. Final report, 15:773 (R;DE;In German)
Treatment of tritium from liquid and solid wastes for the purpose of recycling (input to an enrichment plant). Final report, 15:157 (R;DE;In German)

Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)
Comparative analysis of tritium in water, 1987, 15:1344 (R;DE;In German)
Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1, 15:117 (R;DE;In German)
Experimental investigations of the sensitivity of hydrogen-steam-air mixtures with regard to the deflagration-detonation transition, 15:481 (R;DE;In German)
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)
Survey of incidents in West German nuclear power plants in the second quarter of the year 1989, 15:491 (R;DE;In German)

Bureau of Land Management, Las Cruces, NM (USA). Las Cruces District Office
Proposed Resource Management Plan Amendment/Final Environmental Impact Statement for McGregor Range, 15:1365 (R;US)

Bureau of Land Management, Phoenix, AZ (USA). Arizona State Office
Mt. Trumbull and Mt. Logan wilderness management plan. Draft report, 15:623 (R;US)

Bureau of Mines, Amarillo, TX (USA). Helium Field Operations
Improved method for determination of helium-4 in helium-3 by mass spectrometry. Report of Investigations/1989, 15:933 (R;US)

Bureau of Mines, Denver, CO (USA). Intermountain Field Operation Center
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)

C

California Inst. of Tech., Pasadena, CA (USA)
A new MCRG [Monte Carlo Renormalization Group] calculation of the critical behavior of the 3d ising model - preliminary results, 15:1878 (R;US)

California Univ., Berkeley, CA (USA)
Complete positive ion, electron, and ram negative ion measurements near Comet Halley (COPERNIC) plasma experiment for the European Giotto Mission. Final report, 15 April 1982-31 March 1988, 15:1595 (R;US)

California Univ., Berkeley, CA (USA). Graduate School of Public Policy
Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)

California Univ., Berkeley, CA (USA). Space Sciences Lab.
Study of low-energy electrons over the polar region by using the USAF (United States Air Force) operational DMSP satellite. Final technical report, 15:1619 (R;US)

California Univ., Los Angeles, CA (USA)
Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)
Experiments with metallic and ceramic porous media. Report 30 December 1988, 15:988 (R;US)

California Univ., Riverside, CA (USA)
Molecular biology of seed storage proteins and lectins, 15:1367 (B;US)
Regulation of carbon partitioning in photosynthetic tissue, 15:240 (B;US)

California Univ., San Diego, La Jolla, CA (USA)
Design of catalytic monoliths for closed-cycle carbon dioxide lasers. Final report, 15:1032 (R;US)

California Univ., San Diego, La Jolla, CA (USA). Dept. of Electrical Engineering and Computer Sciences
Scientific background and design specifications for a near-earth heliospheric imager. Final report, 1 March 1985-30 September 1987, 15:1547 (R;US)

California Univ., Santa Barbara, CA (USA)
Great attractor really a great wall, 15:1570 (R;US)

California Univ., Santa Barbara, CA (USA). Environmental Stress Inst.
Maximal aerobic capacity at several ambient concentrations of carbon monoxide at several altitudes. Research report, April 1984-January 1988, 15:1274 (R;US)

Cambridge Systematics, Inc., Berkeley, CA (USA)
Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)

Case Western Reserve Univ., Cleveland, OH (USA)
Publications of the Observatory of the University of Michigan. Volume 12, no. 2: Wavelength identifications in the magnetic CP star HR 4816 (HD 110066), 15:1605 (B;US)

CBI Na-Con, Inc., Oak Brook, IL (USA)
An analytical study of seismic threat to containment integrity, 15:496 (R;US)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie
Separation of tritium from other hydrogen isotopes, 15:220 (R;FR)

Central Electricity Research Labs., Leatherhead (UK)
Estimating the remanent life of boiler pressure parts: Pt. 3. A metallographic technique for life assessment of parent 1Cr1/2Mo steel, 15:761 (R;GB)

Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan)
Accumulation of alveolar macrophages in golden hamster lung after long-term exposure to coal fly-ash particles, 15:37 (R;JP;In Japanese)
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
Behaviors and scale effect of wave reflection and run-up on armored breakwater, 15:1089 (R;JP;In Japanese)
Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)
Hydraulic design on shaft-type energy dissipator of head-tank spillway, 15:237 (R;JP;In Japanese)
Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)
Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)

Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.
ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
Characteristics of electromagnetic wave forms with lightning in winter season, 15:1235 (R;JP;In Japanese)
Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
Experimental study of direct lightning hits on power distribution lines, 15:315 (R;JP;In Japanese)
Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator, 15:313 (R;JP;In Japanese)
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
Model study of the effects of wind on ion current density and electric field at the ground level, 15:314 (R;JP;In Japanese)
Multisolution load flow and index of voltage stability, 15:317 (R;JP;In Japanese)
Optical acoustic sensor using optical fiber, 15:1213 (R;JP;In Japanese)
Simulation model for automatic generation control, 15:321 (R;JP;In Japanese)
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
Survey of adaptive control theory and its applications, 15:322 (R;JP;In Japanese)
Survey on synthesis technologies of methanol as an alternative fuel, 15:228 (R;JP;In Japanese)

Ceskoslovenske Komise pro Atomovou Energii, Prague (Czechoslovakia)
Nuclear power. CAEC lecturers' manual, 15:472 (R;CS;In Czech)

Chemical Dynamics Corp., Upper Marlboro, MD (USA)
Semiclassical theory of polyatomic infrared Multiphoton Processes, phase 1. Appendices A through C. Technical report (Final), 15:1695 (R;US)

City Coll., New York, NY (USA)
Steam conditioning of coal for synfuels production: Second quarterly report, April 1–June 30, 1987, 15:4 (R;US)

Clarkson Coll. of Tech., Potsdam, NY (USA). Dept. of Mathematics
Nonlinear waves. Technical report, 15:1877 (R;US)

Coast Guard Research and Development Center, Groton, CT (USA)
Artic oil-spill response guide for the alaskan beaufort sea. Final report, 15:68 (R;US)

Coastal Science and Engineering, Inc., Columbia, SC (USA)
Review and evaluation of contingency plans for oil and hazardous substances in the upper Great Lakes region. Final report, 15:1326 (R;US)

Coates (J.F.), Inc., Washington, DC (USA)
Why issues emerge: Final report, 15:592 (R;US)

Colorado Geological Survey, Denver, CO (USA)
Preliminary description of quaternary and late pliocene surficial deposits at Yucca Mountain and vicinity, Nye County, Nevada, 15:172 (R;US)

Colorado Research Development Corp., Fort Collins, CO (USA)
Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report, 15:883 (R;US)

Colorado State Univ., Fort Collins, CO (USA). Fluid Mechanics and Wind Engineering Lab.
Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)

Combustion Engineering, Inc., Windsor, CT (USA)
Fuel consolidation demonstration: Spent-fuel storage area analysis, 15:471 (R;US)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina)
Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986, 15:961 (R;AR)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)
Optimization of transmission method for using in safeguards, 15:929 (R;BR;In Portuguese)
Separation of ^{99}Mo from ^{132}Te using thiourea as complexing agent. Application to the separation of ^{99}Mo from the fission products, 15:960 (R;BR)

Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)

Commission of the European Communities, Ispra (Italy). Joint Research Centre
Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)

Commission of the European Communities, Luxembourg (Luxembourg)
Constitutive modelling in the range of inelastic deformations, 15:771 (R;FR)

Computer Sciences Corp., Research Triangle Park, NC (USA)
Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986, 15:1268 (R;US)

CONEG Policy Research Center, Inc., Washington, DC (USA)
Northeast regional biomass energy program: Progress report, July 1989–September 1989, 15:231 (R;US)

Connecticut Coll., New London, CT (USA)
A compact, high-powered far-infrared (FIR) laser: Technical progress report, January 22, 1988 to present, 15:1028 (R;US)

Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)
Separation of tritium from other hydrogen isotopes, 15:220 (R;FR)

Cool Water Coal Gasification Program, Daggett, CA (USA)
Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987, 15:11 (R;US)

Cornell Univ., Ithaca, NY (USA). Center for Environmental Research
Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)

Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)

Cornell Univ., Ithaca, NY (USA). Lab. for Atomic and Solid State Physics
Development of the cn- solid-state vibrational laser. Final report, 1 August 1985-31 October 1988, 15:1018 (R;US)

Creare, Inc., Hanover, NH (USA)
Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989, 15:980 (R;US)

D

Defense Information Analysis Center, Edgewood, MD (USA)
Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989, 15:1224 (R;US)

Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence
Bibliography of Soviet laser developments: January-February 1988, 15:1023 (R;US)

Department of Energy, Billings, MT (USA). Western Area Power Administration
Charlie Creek–Belfield Transmission Line Project, North Dakota: Final Environmental Impact Statement, 15:1364 (R;US)

Department of Energy, London (UK). Energy Efficiency Office
Application of combustion air pre-heating to 50t/h water tube boilers. A demonstration at British Sugar plc. [York], 15:711 (R;GB)
Combined heat and power in a grain whisky distillery. A demonstration at Scottish Grain Distilleries Ltd., Port Dundas, Glasgow, 15:715 (R;GB)
Combined heat and power in a university hall of residence. A demonstration at the University of Keele, 15:687 (R;GB)
Combined heat and power using an aero-derived gas turbine. A demonstration at Smith, Stone and Knight Ltd., Nechells, Birmingham, 15:709 (R;GB)
Copper vapour heat recovery using a spiral heat exchanger. A demonstration at Alloa Brewery Co., 15:708 (R;GB)
Energy management on a medium-sized pharmaceutical production plant. Demonstration at Reckitt and Colman Ltd. [Kingston-upon-Hull], 15:686 (R;GB)
Energy use comparison between conventional reconstruction and hot-drum mix recycling for major trunk roads. A demonstration by Kent County Council. [Maidstone], 15:710 (R;GB)
Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead], 15:225 (R;GB)
Foundry ladle preheater of improved design. A demonstration at North British Steel Group Ltd. [Bathgate], 15:714 (R;GB)
Heat recovery and energy saving using a Baker Perkins Simplex 2000 bread baking oven. A demonstration at Mothers Pride Bakery. [Nottingham], 15:704 (R;GB)
Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)
Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds, 15:707 (R;GB)
Lighting management system for local control through the PABX network. A demonstration at Chase Manhattan Bank NA., London, 15:688 (R;GB)
Minimising operating costs in continuous fabric washing, 15:705 (R;GB)
Retrofitting of structured packing in an atmospheric distillation column. A demonstration at Phillips Petroleum Ltd., North Tees, 15:61 (R;GB)
Straw as a fuel for chalk drying. A demonstration at Needham Chalks Ltd. [Ipswich], 15:232 (R;GB)
Use of stand-by generators for combined heat and power. A demonstration at Perkin Elmer Ltd. [Llantrisant], 15:713 (R;GB)
Waste heat recovery from a heavily contaminated waste stream. A demonstration at Tioxide UK Ltd. [Hartlepool], 15:712 (R;GB)
Waste heat recovery from the absorption stage of a sulphuric acid plant. Demonstration project at Berk Spencer Acids Ltd., London, 15:702 (R;GB)
Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough], 15:706 (R;GB)

Department of Energy, Richland, WA (USA). Richland Operations Office
Grout treatment facility dangerous waste permit application: Drawings: Addendum 1, 15:145 (R;US)

Department of the Army, Washington, DC (USA)
Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures, 15:1017 (P;US)

Department of the Navy, Washington, DC (USA)
Tracking harmonic notch filter, 15:333 (P;US)

Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)
International workshop on calorimeter simulation, 15:1166 (R;DE)

Dortmund Univ. (Germany, F.R.). Lehrstuhl fuer Werkstofftechnologie
Pulsed TIG welding of pipes. Final report, 15:773 (R;DE;In German)

Drexel Univ., Philadelphia, PA (USA)
Inorganic composite materials in Japan: Status and trends, 15:890 (R;US)

Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA)
Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium, 15:919 (TG;US)

Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.
Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)

E

EG and G Idaho, Inc., Idaho Falls, ID (USA)
1989 failure rate screening data for fusion reliability and risk analysis, 15:1930 (R;US)
A comparison of U.S. and European methods for accident scenario, identificaton, selection and quantification, 15:1936 (R;US)
Approaches to cleaning and conversion of coal through bioprocessing, 15:8 (R;US)
Chemical comminution and deashing of low rank coals, 15:21 (R;US)
Contaminant transport in the Snake River Plain Aquifer: Phase 1, Part 1: Simple analytical model of individual plumes, 15:1298 (R;US)
Criticality safety margins provided by moderator control in the TMI-2 dry storage cask, 15:490 (R;US)
Determination of thorium, uranium and transuranium isotopes in siliceous and refractory materials by high-resolution alpha spectrometry, 15:111 (R;US)
Development of the passive safety concept for ITER, 15:1932 (R;US)
DOE hydropower program biennial report 1988–1989: (With updated annotated bibliography), 15:234 (R;US)
Genetic manipulation of acidophilic bacteria, 15:7 (R;US)
Geothermal heat cycle research supercritical cycle with counterflow condenser in different orientations, 15:296 (R;US)
High pressure deuterium-tritium gas target vessels for muon-catalyzed fusion experiments, 15:1884 (R;US)
Identification and selection of initiating events for experimental fusion facilities, 15:1937 (R;US)
Inherent criticality safety margins in spent fuel transportation casks, 15:126 (R;US)
Laboratory testing of Sonnenschein DF6V180 6 volt traction battery, 15:549 (R;US)
Lead management at the INEL [Idaho National Engineering Laboratory], 15:149 (R;US)
Methodology for assessing the radiological consequences of radioactive releases from the CIT [Compact Ignition Tokamak] facility at PPPL [Princeton Plasma Physics Laboratory], 15:1282 (R;US)
MSCAP [Magnet System Circuitry Analysis Program] simulations of TESPE magnet safety transients, 15:1931 (R;US)
Oil shale mining and material handling: Considerations for future research and development, 15:104 (R;US)
PBF/BNCT program for cancer treatment: Volume 3, No. 7, Bulletin, 15:1430 (R;US)
PBF/BNCT [Power Burst Facility/Boron Neutron Capture Therapy] Program for cancer treatment: Bulletin, 15:1428 (R;US)
PBF/BNCT [power burst facility/boron neutron capture therapy] program for cancer treatment: Volume 3, No. 6, 15:1429 (R;US)
Permeation of tritium through HYLIFE-II heat exchanger tubes, 15:1929 (R;US)
Results of field testing of waste forms using lysimeters, 15:148 (R;US)
Safety and environmental analysis of the compact ignition tokamak, 15:1939 (R;US)
Safety implications of a graphite oxidation accident in the compact ignition tokamak device, 15:1933 (R;US)
Safety in the ARIES Tokamak Design Study, 15:1935 (R;US)
Status of spent fuel shipping cask development, 15:987 (R;US)
Study of hydrogen mixing within the Combustion Engineering System 80+ containment, 15:489 (R;US)
Superconducting film fabrication by the sol-gel process, 15:825 (R;US)
The 1988 INEL [Idaho National Engineering Laboratory] microearthquake survey near the western edge of the eastern Snake River Plain, 15:1543 (R;US)
The status of superconducting magnet safety research, 15:1934 (R;US)
Uranium storage bed accident hazards evaluation, 15:1940 (R;US)
US Department of Energy Laboratory Accreditation Program for personnel dosimetry systems (DOELAP), 15:1839 (R;US)
Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory, 15:1318 (R;US)
Volatility from copper and tungsten alloys for fusion reactor applications, 15:1938 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
Avoiding steam-bubble-collapse-induced water hammers in piping systems, 15:336 (R;US)
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 1, User's manual, 15:309 (R;US)
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)
Fuel consolidation demonstration: Spent-fuel storage area analysis, 15:471 (R;US)
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)
Power system planning and engineering–research needs and priorities: Proceedings, 15:649 (R;US)
Proceedings: Reducing power plant emissions by controlling coal quality, 15:310 (R;US)
Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)
Targeted chlorination schedules: Final report, 15:302 (R;US)
Virginia Power's study of a Shell-based GCC [gasification combined-cycle] power plant: Final report, 15:9 (R;US)
Why issues emerge: Final report, 15:592 (R;US)

Electric Research and Management, Inc., State College, PA (USA)
Adaptive protective relaying of transmission power systems for improved reliability, 15:332 (R;US)

Electricity Council Research Centre, Capenhurst (UK)
Accelerated life tests on 11 kV and 33 kV MIND paper cables in the laboratory, 15:326 (R;GB)
Condition monitoring of 132 kv bushings, 15:327 (R;GB)
Description of a simple fault locating device - the magnetic strip fault recorder, 15:324 (R;GB)
Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties, 15:770 (R;GB)
Prediction of remaining lives of 132 kV grid transformers, 15:328 (R;GB)
Remote location of faulted 11 kV cable sections, 15:325 (R;GB)

Electrofusion Corp., Fremont, CA (USA)
High temperature Be panel development, 15:786 (R;US)

Encotech, Inc., Schenectady, NY (USA)
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)

Enertech Consultants, Campbell, CA (USA)
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 1, User's manual, 15:309 (R;US)

Environmental Consulting Engineers, Inc., Knoxville, TN (USA)
Environmental monitoring annual report for the Tumulus Disposal Demonstration Project: Fiscal year 1988, 15:164 (R;US)

Environmental Protection Agency, Chicago, IL (USA). Great Lakes National Program Office
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Drinking Water Research Div.
Removal of uranium from drinking water by conventional treatment methods, 15:1347 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Environmental Monitoring Systems Lab.
Methods for the determination of organic compounds in drinking water, 15:1337 (R;US)
Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment
Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.
Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs, 15:737 (R;US)

Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility
The Eastern Environmental Radiation Facility's participation in interlaboratory and intralaboratory comparisons of environmental sample analyses, 1981–1986, 15:1840 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
Transient phenomena in rotary-kiln incineration, 15:736 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response
Procedures for completion and deletion of National Priorities List sites, 15:617 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment
Workshop report on EPA (Environmental Protection Agency) guidelines for carcinogen risk assessment. Held in Virginia Beach, Virginia on January 11-13, 1989, 15:1462 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste
Best demonstrated available technology (BDAT) background document for K099 (non CBI version). Final report, 15:1351 (R;US)
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Underground Storage Tanks
Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems, 15:80 (R;US)
Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)
Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)

Environmental Research Inst. of Michigan, Ann Arbor, MI (USA)
Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)

EPITAXX, Inc., Princeton, NJ (USA)
Development of a unique laboratory standard: Indium gallium arsenide detector for the 500-1700 nm spectral region. Final report, 15:884 (R;US)

European Space Agency, 75 - Paris (France)
Material degradation in a barium hydroxide latent heat storage pilot unit, 15:547 (R;FR)
On the small-signal gain of free-electron lasers in the low-current region, 15:1029 (R;FR)

F

Fauske and Associates, Inc., Burr Ridge, IL (USA)
Study of hydrogen mixing within the Combustion Engineering System 80+ containment, 15:489 (R;US)

FEC Consultants Ltd., Oldham (UK)
Combined heat and power in a university hall of residence. A demonstration at the University of Keele, 15:687 (R;GB)
Use of stand-by generators for combined heat and power. A demonstration at Perkin Elmer Ltd. [Llantrisant], 15:713 (R;GB)

Fermi National Accelerator Lab., Batavia, IL (USA)
A blanket design, apparatus, and fabrication techniques for the mass production of multilayer insulation blankets for the Superconducting Super Collider, 15:1124 (R;US)
Gravitational radiation from extreme Kerr black hole, 15:1594 (R;US)
Light propagation and the distance-redshift relation in a realistic inhomogeneous universe, 15:1591 (R;US)
Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD), 15:1163 (R;US)
Neutron stars and white dwarfs in galactic halos, 15:1589 (R;US)
Rate for annihilation of galactic dark matter into two photons, 15:1592 (R;US)
Solitosynthesis: Cosmological evolution of non-topological solitons, 15:1580 (R;US)
Statistical fluctuations as the origin of nontopological solitons, 15:1581 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 1, Instrumentation and experimental preparation (300K–80K), 15:1122 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 2, Laboratory results (300K–80K), 15:1123 (R;US)

Florida Agricultural and Mechanical Univ., Tallahassee, FL (USA). Dept. of Physics
Analytical evaluation of the electrostatic potential for diatomic molecules, 15:1691 (R;US)

Florida State Univ., St. Petersburg, FL (USA). Inst. of Oceanography
Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report, 15:1324 (R;US)

Florida Univ., Gainesville, FL (USA)
[Pyruvate decarboxylase: A key enzyme for alcohol production]: Annual performance report, [July 1, 1986–June 30, 1987, 15:242 (R;US)

Florida Univ., Gainesville, FL (USA). Dept. of Chemistry
Development of laser excited atomic fluorescence and ionization spectrometric methods: Progress report, January 1, 1989–October 1, 1989, 15:918 (R;US)

Food and Drug Administration, Washington, DC (USA)
FDA (Food and Drug Administration) Compliance Program Guidance Manual. Section 4. Medical and radiological devices. Irregular report, 15:1465 (R;US)

Forschungszentrum des Deutschen Schiffbaus e.V., Hamburg (Germany, F.R.)
Calculation of steady and transient torsional vibrations of marine diesels of different system configurations and geometry, 15:741 (R;DE;In German)
Statistical prediction of the ship's propulsive power, 15:694 (R;DE;In German)

Foster Wheeler Enviresponse, Inc., Livingston, NJ (USA)
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)

Foster-Miller Associates, Inc., Waltham, MA (USA)
State-of-the-art interior piping systems applications: Single-family buildings. Final report, January 1985-December 1986, 15:100 (R;US)

Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA)
Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989, 15:548 (R;US)

Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik
Materials research with ion beams. Simulation and analysis, 15:939 (R;DE;In German)

G

General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.
Air pollution: Status of dispute over Alaska oil pipeline air quality controls, 15:77 (R;US)
Federal electric power: Controversy relating to construction of transmission lines, 15:650 (R;US)
Gasoline marketing: States' programs for pump labeling of gasoline ingredients, 15:66 (R;US)
Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant, 15:127 (R;US)

General Atomics Co., San Diego, CA (USA)
Inherent criticality safety margins in spent fuel transportation casks, 15:126 (R;US)

Geological Survey of Canada, Ottawa, ON (Canada)
Current research, 15:1467 (R;CA)

Geological Survey, Alexandria, VA (USA)
Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)

Geological Survey, Reston, VA (USA). Water Resources Div.
Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation, 15:1332 (R;US)

Geothermal Research Society of Japan, Tsukuba (Japan)
Exploration and development of geothermal resources, 15:292 (R;JP)

Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)
Absence of parity effects in preequilibrium γ emission, 15:1800 (R;DE)
High energy density in matter produced by heavy ion beams. Annual report, 15:1894 (R;DE)
On a validity of adiabatic approach to the tunneling phenomena, 15:1879 (R;DE)
Physics at SIS/ESR, 15:1775 (R;DE)
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
Space-time effects in the decay of strings by pair-creation, 15:1734 (R;DE)
Studies on the production of high energy densities in matter by intense heavy-ion beams, 15:1895 (R;DE;In German)

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie
Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III, 15:150 (R;DE;In German)

GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)
Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea, 15:1258 (R;DE)
Selective pervaporation of organics from water, 15:938 (R;DE)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)
Physics and technology of nuclear reactors, 15:426 (R;SU;In Russian)

Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires
Constituent approach to high energy elastic scattering of hadrons, 15:1724 (R;FR)
Gas detectors for heavy ions, 15:1164 (R;FR;In French)
High energy gamma-ray production in nuclear reactions, 15:221 (R;FR)

Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules
Cryogenic detectors for particle physics, 15:1168 (R;FR)
Irradiation of superheated superconducting tin granules with low energy photons, at temperatures below 1 k, 15:776 (R;FR)
Neutrinos, dark matter and low temperature detectors, 15:1726 (R;FR)

H

Hamburg Univ. (Germany, F.R.). Fachbereich Physik
Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector, 15:1170 (R;DE;In German)

Hanford Works, Richland, WA (USA)
Review of activities of the national commitee on radiation protection, 15:1431 (R;US)

Harvard Univ., Cambridge, MA (USA)
Fundamental properties of spin-polarized quantum systems: Technical progress report, November 1988–October 1989, 15:1692 (R;US)

Heidelberg Univ. (Germany, F.R.)
Studies on the production of high energy densities in matter by intense heavy-ion beams, 15:1895 (R;DE;In German)

Honeywell, Inc., Golden Valley, MN (USA). Corporate Systems Development Div.
Evaluation of auxiliary-power subsystems for gas-engine heat pumps. Topical report, April 1987-October 1988, 15:102 (R;US)

Houston Univ., TX (USA). Dept. of Civil and Environmental Engineering
Evaluating various adsorbents and membranes for removing radium from ground water, 15:1346 (R;US)

Hughes Aircraft Co., Torrance, CA (USA)
High capacity demonstration of honeycomb panel heat pipes. Final technical report, 15:1052 (R;US)

Humboldt-Universitaet, Berlin (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Hycrude Corp., Chicago, IL (USA)
Beneficiation-hydroretort processing of US oil shales: Volume 2: Final report, 15:105 (R;US)

I

Illinois Association of Recycling Centers, Naperville, IL (USA)
Recycling grants in Illinois: A two year review. Final report, 15:717 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA)
Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report, 1987–1988, 15:51 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering
Numerical bifurcation analysis and parallel processing, 15:1985 (R;US)

Illinois Univ., Urbana, IL (USA)
Control of helium accumulation by fishbones, 15:1921 (R;US)
Neutron stars: A cosmic hadron physics laboratory, 15:1582 (R;US)

Illinois Univ., Urbana, IL (USA). Advanced Construction Technology Center
Metal oxide films from carboxylate precursors, 15:817 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Veterinary Biosciences
Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)

Illinois Univ., Urbana, IL (USA). Laser Aided Materials Processing Lab.
Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)

Implant Sciences Corp., Danvers, MA (USA)
Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989, 15:816 (R;US)

Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (Germany, F.R.)
Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress, 15:772 (R;DE;In German)

Infrared Labs., Inc., Tucson, AZ (USA)
Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)
Introduction to dissociative recombination, 15:1694 (R;US)
Introduction to dissociative recombination, 15:1694 (R;US)
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)

Institute of Gas Technology, Chicago, IL (USA)
Beneficiation-hydroretort processing of US oil shales: Volume 2: Final report, 15:105 (R;US)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)
Specification and characteristics of ion selective electrode for uranium (VI), 15:923 (R;BR;In Portuguese)
Uranium (VI) determination by Radiometric Stripping Analysis (X ray), 15:922 (R;BR;In Portuguese)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores
Components of neutronic state for calculating the phase library in the neutronic simulation of a low power experimental fast reactor, 15:476 (R;BR;In Portuguese)
Two-dimensional suboptimal calibration of the shadow factors in the experimental fast reactor-BR-82, 15:425 (R;BR;In Portuguese)
Utilization of ADE method in the numerical resolution of the neutron Kinetic equation, 15:424 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)
Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)
Lead-lead dating of migmatitic rocks from the region of the Sao Jose dos Campos, Sao Paulo state, Brazil, 15:1472 (R;BR)
Nursering assistance to the radiological accident patients in Goiania-an experience report, 15:1434 (R;BR;In Portuguese)
Uranium determination in $UO_2(NO_3)_2$-HNO_3-H_2O system by precision densimetry, 15:926 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Dept. de Engenharia Quimica
Thorium determination by X-ray Fluorescence Spectrometry in simulated thorex process solutions, 15:925 (R;BR;In Portuguese)

Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)
Proceedings of the 1. Latin-American Conference on Space Geophysics, 15:1554 (R;BR)

Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)
Concentrations of ^{226}Ra and ^{210}Pb in agricultural products surrounding the first brazilian mine and mill in Pocos de Caldas, MG, 15:200 (R;BR;In Portuguese)
Evaluation of the ^{226}Ra transport by rivers sediments surroundings the brazilian uraniums mining and milling, 15:201 (R;BR)

International Bank for Reconstruction and Development, Washington, DC (USA)
Environmental management and economic development, 15:625 (R;US)
New era of petroleum trading: Spot oil, spot-related contracts, and futures markets. Technical paper, 15:67 (R;US)
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)

International Fuel Cells Corp., South Windsor, CT (USA)
Molten carbonate fuel cell technology improvement: Quarterly technical progress report No. 17 for period ending May 1989, 15:657 (R;US)

Iowa Univ., Iowa City, IA (USA)
Auroral plasma waves, 15:1688 (R;US)
Plasma diagnostics package. Volume 2: Spacelab 2 section. Part B: Thesis projects. Final science report, 15:1902 (R;US)
Plasma diagnostics package. Volume 1: OSS-1 section. Final science report, 15:1903 (R;US)
Plasma diagnostics package. Volume 2: Spacelab 2 section, part A. Final science report, 15:1904 (R;US)
Wave emissions from planetary magnetospheres. Final report, 1 June 1985-31 May 1989, 15:1579 (R;US)

Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy
Boundary-layer dynamics in the description of magnetospheric substorms, 15:1541 (R;US)

Itasca Consulting Group, Inc., Minneapolis, MN (USA)
UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)

J

Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment
[Japan Atomic Energy Research Institute] progress report, July 1988–June 1989, 15:1808 (R;JP)

Japan Solar Energy Society, Tokyo (Japan)
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)

Jena Univ. (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Jet Propulsion Lab., Pasadena, CA (USA)
Hypercube matrix computation task. Report, 1986-1988, 15:1830 (R;US)
Solar cell radiation handbook. Addendum 1: 1982-1988, 15:249 (R;US)

Johns Hopkins Univ., Baltimore, MD (USA)
The delineation and interpretation of the earth's gravity field. Annual progress report, 1 June 1988-31 May 1989, 15:1585 (R;US)
The effect of radiation penetration on DNA single-strand breaks in rat skin explants, 15:1426 (R;US)

Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Mechanical Engineering
Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989, 15:753 (R;US)

Johnson (E.R.) Associates, Inc., Oakton, VA (USA)
The incentives and feasibility for direct measurement of spent nuclear fuel characteristics in the Federal Waste Management System, 15:163 (R;US)

Joint Inst. for Nuclear Research, Dubna (USSR)
On the influence of the quadrupole pairing on the energies of the two-quasiparticle states in deformed nuclei, 15:1803 (R;SU)
Photoproduction of pions off nucleons and nuclei, 15:1735 (R;SU)

Second class currents in the μ^--capture by polarized light nuclei, 15:1804 (R;SU)
Some questions of using the algebraic coding theory for construction of special-purpose processors in high energy physics spectrometers, 15:1165 (R;SU)
The present status of the U-400 isochronous cyclotron, 15:1094 (R;SU)
Theoretical aspects of pion photoproduction off light nuclei, 15:1736 (R;SU)

K

Kearney (A.T.), Inc., Alexandria, VA (USA)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington). Volume 1 of 4. Final report, 15:604 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington). Volume 2 of 4. Final report, 15:605 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington) Volume 3 of 4. Final report, 15:606 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington) Volume 4 of 4. Final report, 15:607 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Oregon) Volume 1 of 4. Final report, 15:608 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 2 of 4. Final report, 15:609 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 3 of 4. Final report, 15:610 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon). Volume 4 of 4. Final report, 15:611 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report, 15:612 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report, 15:613 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report, 15:614 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report, 15:615 (R;US)

Kent Univ., Canterbury (UK). Computing Lab.
Brief walk through KAOS (Kent Applicative Operating System), 15:1992 (R;GB)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik
Baryon-baryon interaction and dibaryonic systems. Review and perspectives, 15:1725 (R;DE)
CANU workshop on polarization physics at COSY, 15:1125 (R;DE;In German)
CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, 15:1147 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung
International workshop on calorimeter simulation, 15:1166 (R;DE)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe
Application of the d.c. potential method for continuous crack length measurement in CT samples of Incoloy 800 H at temperatures above 800^{0}C, 15:775 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY
CANU workshop on polarization physics at COSY, 15:1125 (R;DE;In German)
CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, 15:1147 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Material- und Rohstofforschung
Principles and methods for the testing of high-performance ceramics. A survey, 15:1063 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik
Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR, 15:492 (R;DE)
The charged particle transport module CIRCE as part of the KATACO code system, 15:1941 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik
Epitaxial growth and properties of YBaCuO thin films, 15:826 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion
NET model coil test possibilities in the TOSKA TWIN configuration, 15:1942 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit (PRS)
Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR, 15:492 (R;DE)

Kilkelly Environmental Associates, Inc., Raleigh, NC (USA)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
Workshop summary report: Water-quality criteria to protect wildlife resources. Report on pollutants considered to pose the greatest threat to wildlife when existing water-quality criteria are met, 15:1336 (R;US)

KMS Fusion, Inc., Ann Arbor, MI (USA)
Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)

Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie
Parameterization of ice- and water clouds and their radiation-transport properties for large-scale atmospheric models, 15:1237 (R;DE;In German)

Krug International, San Antonio, TX (USA). Technology Services Div.
Ultraviolet-induced photochemical damage in the ocular tissues. Final report, 15:1418 (R;US)

KVB, Inc., Irvine, CA (USA)
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)

L

Lawrence Berkeley Lab., CA (USA)
4.2 K fracture toughness of 304 stainless steel in a magnetic field, 15:780 (R;US)
A program for calculating and plotting soft x-ray optical interaction coefficients for molecules, 15:1215 (R;US)
Collective flow measured with the Plastic Ball, 15:1807 (R;US)
DOE-2 BDL [Building Description Language] summary, Version 2.1D: Revision 5, 15:690 (R;US)
DOE-2 Sample Run Book, Version 2.1D: Revision 3, 15:689 (R;US)
DOE-2 Supplement, Version 2.1D: Revision 5, 15:691 (R;US)
Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
Exploratory studies, 1988, 15:1096 (R;US)

Focal heavy charged particle irradiation of the mammalian cortex: Temporal pattern of changes followed by magnetic resonance imaging and positron emission tomography, 15:1435 (R;US)
Improving the performance of power-limited transverse stochastic cooling systems, 15:1128 (R;US)
Isotopic effects on solubility-limited mass transfer, 15:156 (R;US)
Macrotasking the singular value decomposition of block circulant matrices on the Cray-2, 15:1989 (R;US)
Recent advances in detectors for single-photon counting, 15:1169 (R;US)
STM study of the structure of sulfur ($2\sqrt{3} \times 2\sqrt{3}$)R30° overlayer on rhenium (0001), 15:781 (R;US)
Stopping rules, Bayesian reconstructions and sieves, 15:1214 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 3: Appendices F through I, 15:297 (R;US)
The carcinogenic risks of low-LET and high-LET ionizing radiations, 15:1436 (R;US)
The metallurgical determinants of toughness as cryogenic temperature, 15:779 (R;US)
The science of thermomechanical processing, 15:778 (R;US)
Thermally stable metal/GaAs contacts, 15:878 (R;US)

Lawrence Livermore National Lab., CA (USA)
5th symposium on containment of underground nuclear explosions, 15:1228 (R;US)
A 14-MeV beam-plasma neutron source for materials testing, 15:1971 (R;US)
A simple domain model of flux reversal in ferrites, 15:1129 (R;US)
A study of the utilization of ex-managers, 15:1977 (R;US)
Absolute multilayer characterization at high spatial resolution via real-time soft x-ray imaging, 15:1907 (R;US)
Activity coefficients in aqueous salt solutions: 2, Hydration theory equations, 15:1544 (R;US)
Biomodal spontaneous fission, 15:1791 (R;US)
Charged Particle Beam Research Program quarterly report, January–March 1989, 15:1102 (R;US)
Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)
Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)
Energy and Technology Review, September 1989, 15:631 (R;US)
Equation of state and opacity of dense plasmas, 15:1603 (R;US)
Equation of state data of shock compressed liquid CO_2 and synthetic Uranus, 15:1604 (R;US)
Evaluating the contributions of material control to insider protection, 15:217 (R;US)
Further studies of transverse stress effects in Cable-In-Conduit Conductors, 15:998 (R;US)
Hydrology and radionuclide migration at the Nevada Test Site, 15:171 (R;US)
L-shell photoabsorption spectroscopy for solid metals: Ti, V, Cr, Fe, Ni, Cu, 15:1698 (R;US)
Micro-scale simulation of dynamic compaction of oxide and metal powder mixture, 15:837 (R;US)
Micron-thin Nb films recovered from Mbar shock pressures, 15:800 (R;US)
Non-intrusive verification: Revision 1, 15:1234 (R;US)
Nuclear/conventional interaction in battlefield operations, 15:1232 (R;US)
Operating point selection and burn stability control for the International Thermonuclear Experimental Reactor, 15:1908 (R;US)
Pyrolysis kinetics applied to prediction of oil generation in the Maracaibo Basin, Venezuela, 15:107 (R;US)
Quantifying the link between change in radiative balance and atmospheric temperature, 15:1280 (R;US)
Quantum-mechanical approaches to continuum angular distributions, 15:1881 (R;US)
Shock compression studies of condensed matter, 15:947 (R;US)
Simulation of atmospheric dispersion of radioactivity from the Chernobyl accident, 15:1437 (R;US)
Simulation of mechanical deformation via nonequilibrium molecular dynamics, 15:1067 (R;US)
Starlight: A stationary inertial-confinement-fusion reactor with nonvaporizing walls, 15:1972 (R;US)
The cost effectiveness of modernized US strategic forces, 15:1230 (R;US)
The selection and use of VA/VE [Value Analysis/Value Engineering] professionals, 15:999 (R;US)
Time-dependent free convection in liquid metals, 15:1059 (R;US)
Using object-oriented development to support prototyping, 15:1998 (R;US)
Using small scale tests to estimate the failure diameter of a propellant, 15:230 (R;US)
Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)
Wafer scale RISC [Reduced Instruction Set Computer] processor, 15:1997 (R;US)
Water spray mitigation of hydrofluoric acid releases, 15:727 (R;US)

Leipzig Univ. (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Lenox Inst. for Research, Inc., MA (USA)
Advanced precoat filtration and competitive processes for water purification. Technical report, 15:1333 (R;US)

Lille Univ., 59 - Valenciennes (France). Centre Universitaire
Study and Experiments of a solar energy system with air collector, underground heat storage and recovery with a heat pump, 15:284 (R;FR;In French)

Linde A.G., Hoellriegelskreuth (Germany, F.R.)
Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1, 15:117 (R;DE;In German)

Little (Arthur D.), Inc., Cambridge, MA (USA)
Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)

Lockheed Missiles and Space Co., Huntsville, AL (USA)
Turbine rotor/stator flowfield analysis, 15:1083 (R;US)

Lockheed Missiles and Space Co., Inc., Palo Alto, CA (USA). Research and Development Div.
Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989, 15:752 (R;US)

Los Alamos National Lab., NM (USA)
2000 MCM electrical power jumper cable with controlled flexibility: Design and life cycle test, 15:1954 (R;US)
A delayed-neutron monitor for a liquid-waste stream with high gamma-ray intensity, 15:151 (R;US)
A new system for analyzing neutron multiplicities: Characterization and some specific applications, 15:1805 (R;US)
A safeguards program to implement DOE requirements, 15:214 (R;US)
A source of observational constraints on the structure of Wolf-Rayet winds, 15:1569 (R;US)
Algorithmic randomness, physical entropy, measurements, and the second law, 15:1880 (R;US)
An economic prefeasibility study of geothermal energy development at Platanares, Honduras, 15:293 (R;US)
Analytical treatment of electron trajectory straightener issues in free-electron lasers, 15:1030 (R;US)
Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV, 15:1806 (R;US)
Confinement Physics Research Facility/ZTH: A progress report, 15:1956 (R;US)
Core-level binding energy shifts of the light actinide tetrafluorides and dioxides, 15:1693 (R;US)
CPRF/ZTH front-end torus design and fabrication status, 15:1947 (R;US)
Dark matter and the solar neutrino problem: Can particle physics provide a single solution, 15:1568 (R;US)
Design and construction status of the energy system for the ZTH experiment, 15:1960 (R;US)
Design and drafting document control procedures for CPRF/ZTH experiment, 15:1946 (R;US)
Design of the Los Alamos generator installation, 15:1961 (R;US)
Detonation chemistry studies of energetic materials using laboratory scale samples, 15:1221 (R;US)

Development of inherently safe and environmentally acceptable intelligent processing technologies for HTS materials, 15:877 (R;US)
Dispersion and removal of tritium released into the main cell TSTA [Tritium Systems Test Assembly], 15:1952 (R;US)
Effects of spatial attention on the visual-evoked neuromagnetic response, 15:1402 (R;US)
Electrical insulation system for the shell-vacuum vessel and poloidal field gap in the ZTH machine, 15:1949 (R;US)
Electronic structure of monoclinic $BaBiO_3$, 15:1873 (R;US)
Emulating conventional operator interfaces on window based workstations, 15:1148 (R;US)
ENDF/B-VI six-group delayed neutron data, 15:1798 (R;US)
ENDF/VI six-group delayed neutron data, 15:1797 (R;US)
Energy ratings for metal oxide varistors under repetitively pulsed operation, 15:1948 (R;US)
Exchange currents in double charge exchange, 15:1738 (R;US)
Experiences of fitting isotherms to data from batch sorption experiments for radionuclides on tuffs, 15:154 (R;US)
Fusion fuel purification during the Tritium Systems Test Assembly 3-week loop experiment, 15:1959 (R;US)
Health, Safety, and Environment Division annual report, 1988, 15:1284 (R;US)
High speed transfer switch with 50 kA and 50 kV, 15:1953 (R;US)
Lanczos diagonalizations of the 1-D Peierls-Hubbard model, 15:1852 (R;US)
Maintenance neutron coincidence counter manual, 15:1167 (R;US)
Measurements of neutron emission induced by muons stopped in metal deuteride targets, 15:1883 (R;US)
Monitoring a liquid waste stream with a delayed-neutron instrument, 15:215 (R;US)
Multiple martensitic transformations, incommensurate/commensurate phases and charge-density-wave states in plutonium metal: Their consequences, 15:777 (R;US)
MX chains: 1-D analog of CuO planes?, 15:1872 (R;US)
$NaNi_3Mn_2$ alloy as a tritium storage material, 15:1945 (R;US)
Neutron dieaway methods for criticality safety measurements of fissile waste, 15:153 (R;US)
Remote controlled signal conditioner and fiber optic data link system development CPRF (Confinement Physics Research Facility), 15:1955 (R;US)
Results of investigation at the Miravalles geothermal field, Costa Rica: Part 2, Downhole fluid sampling, 15:294 (R;US)
Rf transistor thermal/electrical characterization, 15:1073 (R;US)
Rotational magnetic processes in $YB_2Cu_3O_7$, 15:875 (R;US)
Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$, 15:876 (R;US)
Safeguards issues relevant to geologic disposal of spent nuclear fuels, 15:152 (R;US)
Separation of helium and hydrogen isotopes by ISS [Isotope Separation System] at the TSTA, 15:1950 (R;US)
Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:457 (R;US)
Synthesis and characterization of VLS [vapor-liquid-solid] silicon carbide whisker reinforced reaction bonded silicon nitride, 15:827 (R;US)
The accelerator automation application toolkit workshop presentations, 15:1095 (R;US)
The ARIES-I high-field-tokamak reactor: Design-point determination and parametric studies, 15:1958 (R;US)
The creation of high energy densities with antimatter beams, 15:1737 (R;US)
The design of the CPRF [Confinement Physics Research Facility] control system, 15:1957 (R;US)
The development of a standard format for accelerator data analysis, 15:1127 (R;US)
The development of an expert system to tune a beam line, 15:1126 (R;US)
The GTP binding protein-dependent activation and deactivation of cGMP phosphodiesterase in rod photoreceptors, 15:1373 (R;US)
Thermal analysis of the CPFR [Confinement Physics Research Facility]/ZTH apparatus, 15:1944 (R;US)
Toroidal magnetic fields in terms of field-line invariants, 15:1943 (R;US)
Transport data libraries for incident proton and neutron energies to 100 MeV, 15:1776 (R;US)
Tritium contamination studies involving test materials and jet remote handling tools, 15:1962 (R;US)
Tritium handling safety and operating experience at the Tritium Systems Test Assembly, 15:1951 (R;US)
Vectorization of Monte Carlo particle transport: An architectural study using the LANL benchmark "GAMTEB", 15:1988 (R;US)
Vertical stability requirements for ARIES-I reactor, 15:1901 (R;US)

Lunar and Planetary Inst., Houston, TX (USA)
Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality, 15:1473 (R;US)

M

Massachusetts Inst. of Tech., Cambridge, MA (USA)
Avoiding steam-bubble-collapse-induced water hammers in piping systems, 15:336 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry
Thermodynamics and kinetics of complex organic systems: Progress report, March 15, 1989–March 14, 1990, 15:936 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Mfg. and Productivity
Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986, 15:1062 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Microsystems Research Center
J-machine: System support for actors. Memorandum report, 15:1978 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center
Kinetic ray tracing in toroidal geometry with application to mode-converted ion-Bernstein waves, 15:1906 (R;US)
Self-field-induced chaotic electron motion in free electron lasers, 15:1036 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics
Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988, 15:1021 (R;US)

Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab.
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)
Wide-band superconductive Chirp filters, 15:982 (R;US)

Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik
A new νanti ν + multiphoton generator derived from KORALZ, 15:1739 (R;DE)
Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector, 15:1170 (R;DE;In German)
Development of novel semiconductor detectors for the detection of ionizing radiation, 15:1171 (R;DE;In German)

Miami Univ., Coral Gables, FL (USA)
Targeted chlorination schedules: Final report, 15:302 (R;US)

Michigan State Univ., East Lansing, MI (USA)
Publications resulting from research supported in whole or in part by this grant: Progress report, September 1987–August 1988, 15:1441 (R;US)

Michigan Univ., Ann Arbor, MI (USA)
Molecular beam epitaxial growth of high-quality InSb on InP and GaAs substrates, 15:885 (R;US)
Nitric acid oxide mixing ratio measurements using a rocket launched chemiluminescent instrument. Final technical report, September 1986-October 1987, 15:1259 (R;US)
Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates, 15:886 (R;US)

Ministry of Nuclear Industry, Taiyuan, SX (China). Inst. of Radiation Protection
Major issues on establishing an emergency plan in nuclear facilities, 15:488 (TJ;US)

Missouri Univ., Independence, MO (USA). Energy Research Lab.
Development of ice self-release mechanisms: Final report, 15:716 (R;US)

Missouri Univ., Rolla, MO (USA)
Modeling of hydrogen-air diffusion flame. Interim report, 15:975 (R;US)

Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)
Physicochemical fundamental of chemical fundamentals of chemical technology. Issue 150. Proceedings of Institute, 15:916 (R;SU;In Russian)

Muenchen Univ. (Germany, F.R.)
Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report, 15:1421 (R;DE;In German)

Multiple Dynamics Corp., Southfield, MI (USA)
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)

N

National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center
Acidic attack of perfluorinated alkyl ether lubricant molecules by metal oxide surfaces, 15:943 (R;US)
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)
Advances in thin-film solar cells for lightweight space photovoltaic power, 15:248 (R;US)
Challenges for future space power systems, 15:275 (R;US)
Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
COLD-SAT: An orbital cryogenic hydrogen technology experiment, 15:990 (R;US)
Comparative thermal analysis of the space station Freedom photovoltaic deployable boom structure using TRASYS, NEVADA, and SINDA programs, 15:250 (R;US)
Comparison of solar photovoltaic and nuclear reactor power systems for a human-tended lunar observatory, 15:272 (R;US)
Concentration of off-axis radiation by solar concentrators for space power, 15:285 (R;US)
CSTI High Capacity Power, 15:401 (R;US)
Dynamic porosity variations in ceramics, 15:828 (R;US)
Estimated performance and future potential of solar dynamic and photovoltaic power systems for selected LEO and HEO missions, 15:274 (R;US)
Flight experiment of thermal energy storage, 15:276 (R;US)
InP (Indium Phosphide): Into the future, 15:246 (R;US)
On the dynamic response of pressure transmission lines in the research of helium-charged free piston Stirling engines, 15:742 (R;US)
On-orbit results of the LIPS 3/InP homojunction solar cell experiment, 15:252 (R;US)
Photovoltaic power system operation in the Mars environment, 15:273 (R;US)
Solar dynamic power module design, 15:277 (R;US)
Solar power for the lunar night, 15:253 (R;US)
Solid surface combustion space shuttle experiment hardware description and ground-based test results, 15:974 (R;US)
Space nuclear reactor shields for manned and unmanned applications, 15:400 (R;US)
Space station freedom photovoltaic power module design status, 15:278 (R;US)
Space station freedom solar array design development, 15:247 (R;US)
Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009, 15:783 (R;US)
The GaAs solar cells with V-grooved emitters, 15:251 (R;US)
Two-dimensional numerical simulation of a Stirling engine heat exchanger, 15:1054 (R;US)

National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center
Workshop on Two-Phase Fluid Behavior in a Space Environment, 15:1056 (R;US)

National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center
A slow positron beam generator for lifetime studies, 15:222 (R;US)
A survey of beam-combining technologies for laser space power transmission, 15:329 (R;US)
Absorbed dose thresholds and absorbed dose rate limitations for studies of electron radiation effects on polyetherimides, 15:882 (R;US)
Analysis of Nd3+:glass, solar-pumped, high-powr laser systems, 15:1031 (R;US)
BRYNTRN: A baryon transport model, 15:1740 (R;US)
Materials Division research and technology accomplishments for FY 87 and plans for FY 88, 15:782 (R;US)

National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center
Development of new techniques for the characterization of crystals and their growth solutions: Center director's discretionary fund. Final report, 15:946 (R;US)
Ideal black hole fluid, 15:1571 (R;US)
Ideal black hole gas, 15:1593 (R;US)
Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report, 15:879 (R;US)
The origin of ultra-compact binaries, 15:1583 (R;US)

National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center
On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)
Recent advances in electronic structure theory and their influence on the accuracy of ab initio potential energy surfaces, 15:944 (R;US)

National Aeronautics and Space Administration, Wallops Island, VA (USA). Wallops Station
Calibration of a photomultiplier array spectrometer, 15:1172 (R;US)

National Aeronautics and Space Administration, Washington, DC (USA)
Comet Halley: The view from Pioneer Venus, 15:1577 (R;US)

National Aerospace Lab., Chofu, Tokyo (Japan)
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)
Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)

National Bureau of Standards, Boulder, CO (USA). Time and Frequency Div.
$^{12}C^{16}O$ laser frequency tables for the 34.2 to 62.3 THz (1139 to 2079/cm) region, 15:1035 (R;US)

National Center for Atmospheric Research, Boulder, CO (USA)
Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)

National Engineering Lab. (NBS), Washington, DC (USA)
Development and use of a tribology research-in-progress data base, 15:1064 (R;US)

National Food Processors Association, Dublin, CA (USA)
Separation, fractionation concentration and drying of food products: Addendum report, April 1, 1988–April 30, 1989, 15:701 (R;US)

National Geophysical Data Center, Boulder, CO (USA)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)

Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous, 15:1600 (R;US)

National Industrial Fuel Efficiency Services Ltd., Altrincham (UK)
Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead], 15:225 (R;GB)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
Respirable quartz exposure at silica flour producers, 1975-1986, 15:1269 (R;US)
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
Trends in coal-mine-dust exposures for longwall miners: 1981-1987, 15:28 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Field Studies and Clinical Investigations
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)

National Inst. for Researches in Inorganic Materials, Tsukuba, Ibaraki (Japan)
Researches on amorphous perovskite, 15:1871 (R;JP;In Japanese)

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA). Reactor Radiation Div.
NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988, 15:932 (R;US)

National Inst. of Standards and Technology (NEL), Boulder, CO (USA). Chemical Engineering Science Div.
Low-temperature thermal conductivity of composites: Alumina fiber/epoxy and alumina fiber/PEEK, 15:889 (R;US)

National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Building Environment Div.
Ventilation and air-quality investigation of the US Geological Survey building, 15:692 (R;US)

National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Electronics and Electrical Engineering
Research for electric energy systems: An annual report, 15:331 (R;US)

National Inst. of Standards and Technology, Gaithersburg, MD (USA). Metallurgy Div.
Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988, 15:160 (R;US)

National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.
MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988, 15:1602 (R;US)

National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.
Statistical treatment of CO_2 data records. Technical memo, 15:1266 (R;US)

National Physical Research Lab., Pretoria (South Africa). Atmospheric Sciences Div.
Design method for pressure vessels containing randomly flawed welds. Technical report, 15:992 (R;ZA)

National Research Council, Washington, DC (USA)
Pharmacokinetics in risk assessment: drinking water and health. Volume 8, 15:1445 (R;US)

National Research Council, Washington, DC (USA). Commission on Life Sciences
Biodiversity, 15:1392 (R;US)

National Technical Information Service, Springfield, VA (USA)
Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:1338 (R;US)
Atmospheric modeling of air pollution. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 15:1276 (R;US)
Carbon dioxide and climate. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1277 (R;US)
Carbon dioxide and climate. January 1970-July 1989 (Citations from Pollution Abstracts). Report for January 1970-July 1989, 15:1278 (R;US)
Centrifuges: fuel technology applications. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:12 (R;US)
Chromium toxicity. January 1987-April 1989 (Citations from the Life Sciences Collection data base). Report for January 1987-April 1989, 15:1409 (R;US)
Cold nuclear fusion and muon-catalyzed fusion. January 1976-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1976-April 1989, 15:1718 (R;US)
Computerized tomography: Technology and equipment. March 1988-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for March 1988-Apr 1989, 15:1404 (R;US)
Computers: Massively parallel processors. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:1993 (R;US)
Electrical-insulating-materials deterioration. January 1970-July 1989 (Citations from the COMPENDEX data base). Report for January 1970-July 1989, 15:891 (R;US)
Electroplating of copper. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:795 (R;US)
Flame retardant polymeric foams: Manufacturing, applications, and hazards. July 1984-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for July 1984-August 1989, 15:893 (R;US)
Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:79 (R;US)
High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988, 15:64 (R;US)
Ion-exchange resins. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:725 (R;US)
Lead exposure: public and occupational health hazards. January 1978-April 1989 (Citations from Pollution Abstracts). Report for January 1978-April 1989, 15:1412 (R;US)
Microbiology of ground water. January 1977-August 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-August 1989, 15:1339 (R;US)
Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations

from the NTIS data base). Report for September 1979-July 1989, 15:744 (R;US)
Nondestructive testing: X-ray radiography techniques. January 1975-October 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-October 1987, 15:1065 (R;US)
Nondestructive testing: X-ray radiography techniques. November 1987-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for November 1987-August 1989, 15:1066 (R;US)
Optical-phase conjugation. January 1979-March 1989 (Citations from the Compendex data base). Report for January 1979-March 1989, 15:1905 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Parallel processors. September 1987-August 1989 (Citations from the COMPENDEX data base). Report for September 1987-August 1989, 15:1994 (R;US)
Photochromic materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:892 (R;US)
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)
Radioactive contamination and radionuclide migration in ground water. January 1970-May 1989 (Citations from the NTIS data base). Report for January 1970-May 1989, 15:1348 (R;US)
Recycling plastic scrap: Injection molding. January 1973-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-August 1989, 15:726 (R;US)
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)
Toxicity of zinc. July 1985-July 1989 (Citations from the NTIS database). Report for July 1985-July 1989, 15:1463 (R;US)
Water-based anticorrosion coatings. January 1980-January 1988 (Citations from World Surface Coatings Abstracts). Report for January 1980-January 1988, 15:796 (R;US)
Water-based anticorrosion coatings. February 1988-July 1989 (Citations from World Surface Coatings Abstracts). Report for February 1988-July 1989, 15:797 (R;US)

National Toxicology Program, Research Triangle Park, NC (USA)
Toxicology and carcinogenesis studies of two pentachlorophenol technical-grade mixtures (CAS No. 87-86-5) in B6C3F1 mice (feed studies). Technical report series, 15:1458 (R;US)

National Transportation Safety Board, Washington, DC (USA). Bureau of Accident Investigation
Railroad accident report: Head-on collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with release of hazardous materials near Altoona, Iowa, on July 30, 1988. Irregular report, 15:697 (R;US)

Naval Medical Research Inst., Bethesda, MD (USA)
Differential sensitivity of human leukocyte subpopulations to ultraviolet light, 15:1417 (R;US)

Naval Ocean Systems Center, San Diego, CA (USA)
End-pumped Nd:BEL laser performance. Professional paper, 15:1020 (R;US)
Nd:BEL laser pumped by laser diodes, 15:1019 (R;US)

Naval Research Lab., Washington, DC (USA)
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim), 15:1022 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)
Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report, 15:1618 (R;US)

New Energy Development Organization, Tokyo (Japan)
Review of research and evaluation methods for environmental survey in geothermal development, 15:295 (R;JP;In Japanese)

New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center
Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)

New York Univ., NY (USA)
Amplification of oncogenes in early-stage, radiation-induced rat skin tumours, 15:1370 (R;US)

New York Univ., NY (USA). Courant Inst. of Mathematical Sciences
Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)

New York Univ., NY (USA). Dept. of Chemistry
Base sequence effects on interactions of aromatic mutagens with DNA [deoxyribonucleic acid]: Progress report, December 1, 1988–October 15, 1989, 15:1371 (R;US)

New York Univ., NY (USA). Dept. of Environmental Medicine
The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990, 15:1425 (R;US)

NIFES Ltd., Buntingford (UK)
Waste heat recovery from the absorption stage of a sulphuric acid plant. Demonstration project at Berk Spencer Acids Ltd., London, 15:702 (R;GB)

North Carolina State Univ., Raleigh, NC (USA)
Research at and operation of the material science x-ray absorption beamline (X-11) at the National synchrotron light source: Annual progress report, 15:1146 (R;US)

North Carolina Univ., Chapel Hill, NC (USA). Dept. of Environmental Sciences and Engineering
Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)

Northeast Utilities Service Co., Berlin, CT (USA)
Fuel consolidation demonstration: Spent-fuel storage area analysis, 15:471 (R;US)

Northern States Power Co., Minneapolis, MN (USA)
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)

Northrop Research and Technology Center, Palos Verdes Peninsula, CA (USA)
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
Technology, safety and costs of decommissioning reference nonfuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management
Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988, 15:160 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards
Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards
Regulating the disposal of low-level radioactive waste: A guide to the Nuclear Regulatory Commission's 10 CFR part 61, 15:158 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
NRC regulatory information conference: Proceedings, 15:493 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
Records important for decommissioning of nuclear reactors, 15:502 (R;US)
Standard format and content for decommissioning plans for nuclear reactors, 15:501 (R;US)
Transactions of the seventeenth water reactor safety information meeting, 15:494 (R;US)

Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)
Treatment of tritium from liquid and solid wastes for the purpose of recycling (input to an enrichment plant). Final report, 15:157 (R;DE;In German)

O

Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.
Safeguards and security recommendations for the OCRWM [Office of Civilian Radioactive Waste Management] Federal Waste Management System, 15:213 (R;US)

Oak Ridge National Lab., TN (USA)
"Integrase" protein of murine leukemia viruses, 15:1368 (R;US)
A comparative study of six data sources' ability for estimating interstate motor carrier VMT [vehicle miles of travel], 15:1466 (R;US)
A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)
Adaptive protective relaying of transmission power systems for improved reliability, 15:332 (R;US)
Agency for toxic substances and disease registry: Annual report for FY 1987, October 1, 1986–September 30, 1987, 15:1442 (R;US)
Antarctic surface temperature and pressure data, 15:1239 (R;US)
Application of neural networks for fault diagnosis in plant production, 15:1983 (R;US)
Building Shielding Facility quarterly report, April, May, and June 1989, 15:499 (R;US)
Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)
Conversion of enriched isotopes of sulfur from SF_6 to a suitable compound for feed to the electromagnetic calutron separators, 15:917 (R;US)
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
Deformation twinning in ordered intermetallic compounds, 15:765 (R;US)
Demonstration of criticality safety for the modified TN-REG and TN-BRP transport/storage casks, 15:986 (R;US)
Demonstrations of technology for remediation and closure of Oak Ridge National Laboratory waste disposal sites, 15:165 (R;US)
Design features of an axial-geometry, plasma-sputter, heavy negative ion source, 15:1113 (R;US)
Determination of ICRF antenna fields in the vicinity of a 3-D Faraday shield structure, 15:1923 (R;US)
Development of ice self-release mechanisms: Final report, 15:716 (R;US)
Electricity savings and one and two years after weatherization: A study of 1986 participants in Bonneville's Residential Weatherization Program, 15:653 (R;US)
Electron heating and static sheath enhancement in front of energized rf antennas, 15:1926 (R;US)
Elicitation of natural language representations of uncertainty using computer technology, 15:1987 (R;US)
Empirical and analytical determination of the fracture resistance of a TiB_2 particle/SiC matrix composite, 15:824 (R;US)
ENDF/VI six-group delayed neutron data, 15:1797 (R;US)
Environmental boundaries to energy development, 15:616 (R;US)
Environmental regulatory update table, 15:1299 (R;US)
Environmental Regulatory Update Table, September 1989, 15:1300 (R;US)
Environmental Sciences Division Toxicology Laboratory standard operating procedures, 15:1443 (R;US)
Evaluation of shielding analysis methods for spent fuel casks, 15:125 (R;US)
Experimental evaluation of the liquid deuterium fill fraction of the horizontal cold source moderating cell, 15:387 (TG;US)
Experimental evidence of increased electron temperature, plasma potential, and ion energy near an ICRF antenna Faraday shield, 15:1925 (R;US)
Fiber-optic sensors for composite cure analysis and lifetime nondestructive evaluation, 15:871 (R;US)
Heavy ions as probes of nuclei far from stability, 15:1780 (R;US)
Horizontal cold source: Experimental cooling tests of the horizontal cold source cell with nitrogen gas, 15:427 (TG;US)
How far can the world get on energy efficiency alone?, 15:588 (R;US)
ICRF Faraday shield plasma sheath models: Low and high conductivity limits, 15:1924 (R;US)
Inspection of contaminated hot cell ductwork, 15:991 (R;US)
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)
Isotope driven critical scattering and phase separation in mixtures of deuterated and protonated polymers, 15:874 (R;US)
Large break loss-of-coolant accident analyses for the high flux isotope reactor, 15:483 (R;US)
Loss-of-coolant accident experiment at the AVR gas-cooled reactor, 15:485 (R;US)
Magnetic excitations in thulium metal, 15:1849 (R;US)
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
MHD equilibrium and stability considerations for high-aspect-ratio ARIES-I tokamak reactors, 15:1888 (R;US)
Microstructural evolution of martensitic steels during fast neutron iradiation, 15:1920 (R;US)
Mobility of colloidal particles in the subsurface: Chemistry and hydrology of colloid-aquifer interactions: International series of interactive seminars summary report, 15:1468 (R;US)
Molybdenum disilicide as a component of modern composites for application at high temperatures, 15:887 (TJ;US)
Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 15:1160 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Jet fuel conversion by Pacific fuel suppliers and impacts on Navy fuel availability, 15:63 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Impacts of ultra low sulfur diesel fuel production on Navy fuel availability, 15:78 (R;US)
Oak Ridge Research Reactor shutdown maintenance and surveillance quarterly report, April, May, and June 1989, 15:477 (R;US)

ORNL Drawing Q-6240-2 (Rev.3) and Parts List Q-6240-5 (Engineering Materials), 15:1072 (E;US)
Physical and chemical interactions in irradiated water containing DNA, 15:1423 (R;US)
Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)
Reports management, 15:2011 (R;US)
Results of the radiological survey at 7 Hancock Street, Lodi, New Jersey (LJ027), 15:1308 (R;US)
Results of the radiological survey at 5 Hancock Street, Lodi, New Jersey (LJ029), 15:1309 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060), 15:1311 (R;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Risk and safety analysis in support of the operation at the High Flux Isotope Reactor at Oak Ridge, 15:484 (R;US)
Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final, 15:732 (R;US)
Sampling and analysis protocols and project description for the Integrated Forest Study, 15:1262 (R;US)
Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations, 15:1257 (R;US)
Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy, 15:1870 (R;US)
Studies of plasma performance and transport in the advanced toroidal facility (ATF), 15:1889 (R;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)
Summary of experimental and calculational results from the joint US-DOE/PNC criticality data development program, 15:119 (R;US)
Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)
Tests on wall temperatures of the moderator cell of the D_2 cold source in equilibrium and transient regimes, 15:388 (TG;US)
TF-ripple loss of suprathermal alphas in ITER: Progress report, 15:1890 (R;US)
The 11th Werner Brandt workshop on charged particle penetration phenomena, 15:1850 (R;US)
The CIT [compact ignition tokamak] pellet injection system: Description and supporting research and development, 15:1919 (R;US)
The continuing evolution of the Federal Radiological Emergency Response Plan, 15:1422 (R;US)
The incentives and feasibility for direct measurement of spent nuclear fuel characteristics in the Federal Waste Management System, 15:163 (R;US)
The LAW [Library to Analyze Waste] library: A multigroup cross section library for use in radioactive waste analysis calculations, 15:141 (R;US)
Theoretical analysis of reactivity measurement with the ^{252}CF source ratio method, 15:423 (R;US)
Thermodynamic and fluid dynamic experiments for the horizontal cold source of the Grenoble high flux reactor, 15:386 (TG;US)
Thermophoretic transport of particles that act as volumetric heat sources in natural convection flow, 15:338 (R;US)
Transportation energy data book: Edition 10, 15:696 (R;US)
Uncertainties associated with the use of the KENO Monte Carlo criticality codes, 15:422 (R;US)
What was learned in developing the 1987 Zion Federal Field Exercise that can be used in planning other emergency response exercises?, 15:482 (R;US)
X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)
[7th international conference on ceramics]: Foreign trip report, December 12–18, 1988, 15:835 (R;US)
[Advanced ceramics for fusion applications]: Foreign trip report, June 17, 1988–June 25, 1988, 15:1965 (R;US)
[Application of electron microscopy for the analysis of the mechanical behavior of advanced ceramics]: Foreign trip report, June 3, 1988–June 13, 1988, 15:831 (R;US)
[Atom probe field-ion microscopy research on silicon carbide whiskers and evaluate the position sensitive atom probe]: Foreign trip report, September 28, 1988–October 9, 1988, 15:1174 (R;US)
[Ceramic powder characterization]: Foreign trip report, October 7–14, 1988, 15:834 (R;US)
[Data acquisition and analysis of data from highly segmented Ge gamma-ray detectors]: Foreign trip report, September 3, 1989–September 30, 1989, 15:1175 (R;US)
[Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988, 15:832 (R;US)
[Environmental transport of radionuclides]: Foreign trip report, September 14–26, 1989, 15:1285 (R;US)
[Field-scale water and solute flux in soils]: Foreign trip report, September 21–30, 1989, 15:1416 (R;US)
[French technological progress in the field of robotics and teleoperation]: Foreign trip report, September 9,1989–September 30, 1989, 15:1991 (R;US)
[Future of electron microscopy]: Foreign trip report, September 11–30, 1989, 15:792 (R;US)
[Gas-cooled reactor materials]: Foreign trip report, June 11–16, 1988, 15:382 (R;US)
[Geometrical structural properties in the selvedge region of surfaces of random alloys]: Foreign trip report, July 21–September 30, 1989, 15:794 (R;US)
[Global natural resource monitoring and assessment]: Foreign trip report, September 23–October 7, 1989, 15:1301 (R;US)
[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)
[International Energy Agency workshop on fusion materials database]: Foreign trip report, June 5, 1988–June 11, 1988, 15:1964 (R;US)
[Lithium and lead-lithium corrosion and chemistry]: Foreign trip report, September 18–26, 1989, 15:793 (R;US)
[Low activation alloys for fusion reactors]: Foreign trip report, August 13, 1988–August 27, 1988, 15:1966 (R;US)
[Managing the global environment]: Foreign trip report, September 9, 1989–September 23, 1989, 15:1261 (R;US)
[Materials for hot gas cleanup in coal conversion and utilization systems]: Foreign trip report, May 31, 1988–June 16, 1988, 15:10 (R;US)
[Materials for magnetic fusion energy systems]: Foreign trip report, August 30, 1988–September 9, 1988, 15:1967 (R;US)
[Modeling and experimental efforts on ordered intermetallic alloys]: Foreign trip report, May 21–June 5, 1988, 15:787 (R;US)
[Physical metallurgy and mechanical behavior of ordered intermetallics]: Foreign trip report, January 19, 1989–February 3, 1989, 15:789 (R;US)
[Prospect for wavelength tunable lasers based on vacancy defects in alkaline-earth oxides]: Foreign trip report, September 18, 1989–September 30, 1989, 15:1034 (R;US)
[Radiation damage correlation for fusion conditions]: Foreign trip report, September 25, 1989–October 5, 1989, 15:1968 (R;US)
[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)
[Structural design criteria for HTGR reactors]: Foreign trip report, January 29, 1989–February 3, 1989, 15:384 (R;US)
[Structural design criteria for HTGR reactors]: Foreign trip report, January 28, 1989–February 5, 1989, 15:385 (R;US)
[Studies on fusion materials]: Foreign trip report, June 5, 1989–June 15, 1989, 15:1963 (R;US)

[Surface engineering by high energy beams]: Foreign trip report, September 23–October 6, 1989, 15:1853 (R;US)
[Surface modification of metals by ion beams]: Foreign trip report, August 24, 1988–October 11, 1988, 15:833 (R;US)
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)
[Welding and melting by electron and laser beams]: Foreign trip report, September 11–October 2, 1988, 15:788 (R;US)
[Welding under extreme conditions]: Foreign trip report, August 29, 1989–September 14, 1989, 15:791 (R;US)

Oak Ridge Y-12 Plant, TN (USA)
A study of the effect of temperature on the measurement of a hemishell by the development coordinate measuring machine, 15:1001 (R;US)

Office of Technology Assessment (U.S. Congress), Washington, DC (USA)
Technologies for reducing dioxin in the manufacture of bleached wood pulp. Background paper, 15:738 (R;US)

Ohio Dept. of Natural Resources, Columbus, OH (USA). Div. of Geological Survey
Analysis of stratigraphic and production relationships of Devonian-shale gas reservoirs in Ohio. Final report, October 1985-November 1988, 15:86 (R;US)

Ohio State Univ., Columbus, OH (USA). High-Energy Physics Lab.
Doubly-fluted tubes and enhanced tubes in confined crossflow. Annual report, August 1987-July 1988, 15:1057 (R;US)

Oklahoma Univ., Norman, OK (USA). School of Chemical Engineering and Materials Science
Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)

Old Dominion Univ., Norfolk, VA (USA)
Comparison of laser models. Progress report, period ended 15 May 1989, 15:1033 (R;US)

Optical Society of America, Washington, DC (USA)
Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)

Oregon State Univ., Corvallis, OR (USA)
Oregon State University nuclear chemistry progress report, August 1, 1988–August 1, 1989, 15:1794 (R;US)

Ortel Corp., Alhambra, CA (USA)
Pigtailed single-mode diode lasers. Final report, 20 September 1988-30 April 1989, 15:1026 (R;US)

Oxford Univ. (UK)
Oscillations in D-region absorption at periods of one to two months, 15:1586 (R;GB)

P

Pacific Northwest Lab., Richland, WA (USA)
Development of international exemption principles for recycle and reuse, 15:500 (R;US)
Effective sample labeling, 15:167 (R;US)
Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill, 15:1303 (R;US)
Identification of contaminants of concern in Hanford ground waters, 15:1341 (R;US)
Low-temperature conversion of high-moisture biomass: Continuous reactor system results, 15:254 (R;US)
Reactivity measurements on an experimental assembly of 4.31 wt % ^{235}U enriched UO_2 fuel rods arranged in a shipping cask geometry, 15:128 (R;US)
Residential energy efficiency and fuel choice, 15:654 (R;US)
Spent fuel performance in geologic repository environments, 15:168 (R;US)
Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation, 15:798 (R;US)
Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)
Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)
Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988, 15:166 (R;US)

PEI Associates, Inc., Cincinnati, OH (USA)
Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments, 15:721 (R;US)

Pennsylvania State Univ., University Park, PA (USA)
The search for absorption of 1 keV X-rays by the Small Magellanic Cloud, 15:1590 (R;US)

Perpignan Univ., 66 (France)
Delayed thermal supply in a building using a heat collector and storage porous concrete wall, 15:282 (R;FR;In French)

Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)
Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III, 15:150 (R;DE;In German)

Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
Novel experimental studies for coal liquefaction: Final report, 15:5 (R;US)

Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)
Geochemical study of main elements and trace elements in soils of three profiles in the state of Santa Catarina, 15:920 (R;BR;In Portuguese)

Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica
Determination of uranium (IV) in cloride solutions of enrichment columns by spectrometry with flow injection, 15:924 (R;BR;In Portuguese)

Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA)
Application of Advanced Material for Turbomachinery and Rocket Propulsion, 15:756 (R;US)

Pratt and Whitney Aircraft, East Hartford, CT (USA)
MATE program: erosion resistant compressor airfoil coating, volume 2. Final report, 15:829 (R;US)

Princeton Univ., NJ (USA). Dept. of Electrical Engineering and Computer Science
System theoretic models for high-density VLSI (very large scale integration) structures. Final technical report, 15:1979 (R;US)

Princeton Univ., NJ (USA). Plasma Physics Lab.
Charge states of high Z atoms in a strong laser field, 15:1696 (R;US)
Cryosorption of helium on argon frost TFTR [Tokamak Fusion Test Reactor] neutral beamlines, 15:1970 (R;US)
Some considerations of "cold fusion" including the calculation of fusion rates in molecules of hydrogen isotopes, 15:1885 (R;US)
The tokamak as a neutron source, 15:1969 (R;US)

Purdue Univ., Lafayette, IN (USA). Water Resources Research Center
Contribution of subsoil and aquifer microorganisms to groundwater quality. Technical report, 1 July 1988-30 June 1989. (Final), 15:1334 (R;US)

R

Radian Corp., Austin, TX (USA)
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)

Radian Corp., Research Triangle Park, NC (USA)
Quality-assurance procedures: Method 28A measurement of air-to-fuel ratio and minimum burn rate for wood-fired appliances, 15:1267 (R;US)

RE/SPEC, Inc., Rapid City, SD (USA)
Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0, 15:142 (R;US)

Regional Economic Research, Inc., San Diego, CA (USA)
Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)
Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)

Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)

Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)
Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah, 15:1229 (R;US)

Risoe National Lab., Roskilde (Denmark)
Department of Energy Technology Annual Progress Report, 1 January-31 December 1988, 15:626 (R;DK)

Roberts and Schaefer Co., Salt Lake City, UT (USA)
Beneficiation-hydroretort processing of US oil shales, engineering study: Volume 3, Final report, 15:106 (R;US)

Rochester Univ., NY (USA). Dept. of Physics and Astronomy
Nijenhuis tensor and integrable models, 15:1764 (R;US)

Rochester Univ., NY (USA). School of Medicine and Dentistry
Responses of susceptible subpopulations to nitrogen dioxide. Research report, June 1983-January 1988, 15:1461 (R;US)

Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant
In-drum vitrification of transuranium waste sludge using microwave energy, 15:169 (R;US)

Royal Armament Research and Development Establishment, Westcott (UK)
Design assessment for metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic composite overwind, 15:979 (R;GB)

Ruhr-Univ., Bochum (Germany, F.R.). Fakultaet fuer Geowissenschaften
Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988, 15:1542 (R;DE)

S

S-Cubed, La Jolla, CA (USA)
Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)

Saint Charles County Water Dept., St. Charles, MO (USA)
St. Charles county well field monitoring project: Quarterly report, July, August and September 1989, 15:144 (R;US)

Sandia National Labs., Albuquerque, NM (USA)
A laboratory test for fuel injector deposit studies, 15:743 (R;US)
Accident progression analysis of past severe accidents, 15:503 (R;US)
Application of item and personnel tracking to materials control, 15:216 (R;US)
Calculation of natural convection boundary layer profiles using the local similarity approach including turbulence and mixed convection, 15:46 (R;US)
Cemented NbC-Co for geothermal drilling applications: Final report, 15:298 (R;US)
Characterization and development report for the SA3259: An operational amplifier, 15:1074 (R;US)
Characterizing transient vibrations using band limited moments, 15:1233 (R;US)
Current status of InAsSb strained-layer superlattice infrared detectors: Demonstration of a high detectivity, 10 μm photodiode, 15:255 (R;US)
Detuning ion hose with a time varying axial magnetic field, 15:1697 (R;US)
Discrete ordinates methods for radiation transport, 15:473 (R;US)
Electrical breakdown in vacuum: Working group report, 15:997 (R;US)
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)
Gelled propellant flow: Boundary layer theory for power-law fluids in a converging planar channel, 15:1058 (R;US)
Generalization in backpropagation networks: An empirical study using image data, 15:1995 (R;US)
High-temperature electronics available now and plans for the future, 15:1076 (R;US)
How to successfully move data between a personnel mainframe HRIS and the REGISTRAR, 15:1996 (R;US)
Hydrogen assisted cracking of palladium modified PH 13-8 Mo stainless steel, 15:799 (R;US)
MELCOR analyses of drywell flammability, 15:340 (R;US)
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)
Predictive aging of elastomers in air: The importance of understanding diffusion-limited oxidation effects, 15:896 (R;US)
Results from electromagnetic surface surveys to characterize the Culebra aquifer at the WIPP [Waste Isolation Pilot Plant] site, 15:170 (R;US)
Solving the blow-by problem in a two-stage gun, 15:996 (R;US)
Studies of the adsorption/desorption behavior of explosive-like molecules, 15:1222 (R;US)
TA705 Data Retention Chassis operating manual, 15:1075 (R;US)
The effects of heavy particle radiation on semiconductor devices, 15:1211 (R;US)
Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB), 15:1223 (R;US)

Sandia National Labs., Livermore, CA (USA)
Coal combustion science: Quarterly progress report, April–June 1989, 15:33 (R;US)
SAND DEVIL: A digital video link for telemetry applications, 15:1216 (R;US)

Sao Paulo Univ., SP (Brazil). Inst. de Quimica
Addition compounds between lanthanide trifluoromethane sulphonates and N,N,N',N' - tetrametilmalonamida (TMMA), 15:928 (R;BR;In Portuguese)

Sargent and Lundy, Chicago, IL (USA)
An analytical study of seismic threat to containment integrity, 15:496 (R;US)

Science Applications International Corp., Bellevue, WA (USA)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Pesticide application, 15:722 (R;US)

Scientific Systems, Inc., Cambridge, MA (USA)
Optimal sensor configuration and survivable processing with correlated noise. Final report, 15:1227 (R;US)

Shirley Inst., Manchester (UK)
Minimising operating costs in continuous fabric washing, 15:705 (R;GB)

Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.)
PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report, 15:354 (R;DE;In German)

Simco, Inc., Weston, CT (USA)
Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report, 15:647 (R;US)

Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory
A Normal Incidence X-ray Telescope (NIXT) sounding rocket payload. Final report, 1 November 1982-31 January 1989, 15:1173 (R;US)

Smithsonian Institution, Washington, DC (USA)
Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report, 15:1390 (R;US)

Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil)
Age of the rocks and the metamorphic episodes from the Southeastern of Sao Paulo state, 15:1469 (R;BR;In Portuguese)
Geochronological data for lithostratigraphic complexes of a crystalline basement from the South regions of Minas Gerais and adjacent areas of the Sao Paulo state, 15:1471 (R;BR;In Portuguese)
K-Ar geochronology of mafic dyke swarms from the meridional part of Sao Francisco craton and implications on tectonic context, 15:1470 (R;BR;In Portuguese)

Solar Energy Research Inst., Golden, CO (USA)
Application of solar technologies in buildings, 15:280 (R;US)
Energy conservation technical information guide: Volume 3, Residential buildings, 15:693 (R;US)

SERI [Solar Energy Research Institute] Resource Assessment Project: FY 1987 annual progress report, 15:239 (R;US)

Solmecs Ltd., Jerusalem (Israel)
Development of a wet vapor homogeneous liquid metal MHD power system: Semi-annual report, October 1988–March 1989, 15:655 (R;US)

South Carolina State Coll., Orangeburg, SC (USA). Dept. of Natural Sciences
Composition of phytoplankton communities and their contribution to secondary productivity in Carolina Bays on the Savannah River Plant: Year one report, 15:1323 (R;US)

South Carolina Univ., Columbia, SC (USA). Savannah River Archaeological Research Program
Savannah River Archaeological Research Program annual report, Fiscal years 1988–1989, 15:1362 (R;US)

Southern Co. Services, Inc., Birmingham, AL (USA)
Power system planning and engineering–research needs and priorities: Proceedings, 15:649 (R;US)

Southern Research Inst., Birmingham, AL (USA)
Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)

Southwest Research Inst., San Antonio, TX (USA)
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)

Space Computer Corp., Santa Monica, CA (USA)
Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989, 15:1070 (R;US)

Space Power, Inc., San Jose, CA (USA)
Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 1. Objectives, summary results and introduction. Final report, 15:397 (R;US)
Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 4: Concepts selection, conceptual designs, recommendations, *5:398 (R;US)
Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 3, technologies 2: Power conversion. Final report, 15:399 (R;US)

Spire Corp., Bedford, MA (USA)
Substrate heating for the formation of silicon-on-insulator structures by oxygen implantation. Final report, 15:888 (R;US)

SRI International, Menlo Park, CA (USA)
Chemical and catalytic activation of methane by metal oxide surfaces. Annual report, September 1, 1987-August 31, 1988, 15:227 (R;US)
Ionospheric scintillation studies. Final report, October 1984-September 1987, 15:1616 (R;US)

SRI International, Menlo Park, CA (USA). Materials Research Lab.
Cemented NbC-Co for geothermal drilling applications: Final report, 15:298 (R;US)

Stanford Univ., CA (USA)
Investigation of ground-based observations of solar oscillations at Stanford, 15:1575 (R;US)
Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989, 15:880 (R;US)
Solar g-mode oscillations: Comparison of SMM-ACRIM and ground-based observations. Final report, 1 July 1987-30 June 1988, 15:1576 (R;US)
The evolution of energetic particles and the emitted radiation in solar flares. Ph.D. Thesis, 15:1584 (R;US)

Stanford Univ., CA (USA). Dept. of Computer Science
Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988, 15:981 (R;US)

Stanford Univ., CA (USA). Dept. of Petroleum Engineering
Reservoir characterization for the CO_2 enhanced oil recovery process: Final report, 15:52 (R;US)

State Univ. of New York, Buffalo, NY (USA). Dept. of Chemistry
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

Steinmueller (L.U.C.) G.m.b.H., Gummersbach (Germany, F.R.). Fachbereich Forschung und Entwicklung
Development and testing of a staged-mixing burner with injection of additives for the simultaneous reduction of SO_2 and NO_x emissions in coal and oil firing systems, 15:1085 (R;DE;In German)

Sterling Federal Systems, Inc., Palo Alto, CA (USA)
Flux Jacobian matrices and generaled Roe average for an equilibrium real gas, 15:1717 (R;US)

Stone and Webster Engineering Corp., Boston, MA (USA)
Targeted chlorination schedules: Final report, 15:302 (R;US)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)

Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt
Quantitative analysis of the precipitation conditions in fine grained structural steel for materials characterization, 15:774 (R;DE;In German)

Sverdrup Technology, Inc., Cleveland, OH (USA)
Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report, 15:881 (R;US)

SVL Associates, Laguna Hills, CA (USA)
Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report, 15:651 (R;US)

Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment
Information profiles on potential occupational hazards: Nitroparaffins. Draft report (Second), 15:1448 (R;US)
Information profiles on potential occupational hazards: Phthalates. Draft report (Second), 15:1450 (R;US)
Information profiles on potential occupational hazards: Aminoazobenzenes. Draft report (Second), 15:1451 (R;US)
Information profiles on potential occupational hazards: Inorganic azides. Draft report (Second), 15:1452 (R;US)
Information profiles on potential occupational hazards: nitrophenols. Draft report (Second), 15:1453 (R;US)
Information profiles on potential occupational hazards: Chlorophenols. Draft report (Second), 15:1457 (R;US)
Information profiles on potential occupational hazards: Organic anhydrides. Draft report (Second), 15:1459 (R;US)
Information profiles on potential occupational hazards: Inorganic chromium compounds. Draft report (Second), 15:1460 (R;US)
Review and evaluation of recent scientific literature relevant to an occupational standard for ethylene dibromide, 15:1449 (R;US)

Syracuse Univ., NY (USA)
Research program in elementary particle theory: Progress report for period ending December 31, 1989, 15:1765 (R;US)

Syracuse Univ., NY (USA). Dept. of Physics
Research program in elementary particle theory: Outstanding junior investigator program: Progress report for period ending December 31, 1989, 15:1766 (R;US)

T

Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften
Calculation of concentration profiles and their experimental verification with a pulsed sieve-plate column and the reactive material system of uranyl nitrate, nitric acid/tributyl phosphate, kerosine, 15:122 (R;DE;In German)

Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik
Development of novel semiconductor detectors for the detection of ionizing radiation, 15:1171 (R;DE;In German)

Technische Univ., Dresden (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Tennessee Univ., Knoxville, TN (USA). Dept. of Physics
Magnetic behavior of curium and americium-curium alloys, 15:768 (R;US)

Texas A and M Univ., College Station, TX (USA). Dept. of Civil Engineering
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)

Texas A and M Univ., College Station, TX (USA). Dept. of Physics
Gigatron, a new technology for microwave power devices, 15:1114 (R;US)

Texas Office of the Governor, Austin, TX (USA)
Characterization of oil and gas reservoir heterogeneity: Second quarterly report, July 15–October 15, 1989, 15:47 (R;US)

Texas Univ., Austin, TX (USA)
Distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter dominated universe, 15:1572 (R;US)
Near-infrared spectroscopy of young stellar objects. Ph.D. Thesis, 15:1606 (B;US)

Texas Univ., Austin, TX (USA). Fusion Research Center
Transport modeling and advanced computer techniques, 15:1893 (R;US)

Toulouse-3 Univ., 31 (France)
Contribution to the modelling of passive solar buildings. Validation and study of the sensitivity factors, 15:283 (R;FR;In French)

U

UKAEA Harwell Lab. (UK). Energy Technology Div.
Technology module for shoreline wave energy conversion in the UK, 15:299 (R;GB)

Umweltbundesamt, Berlin (Germany, F.R.)
Development and testing of a staged-mixing burner with injection of additives for the simultaneous reduction of SO_2 and NO_x emissions in coal and oil firing systems, 15:1085 (R;DE;In German)

UNC Geotech, Grand Junction, CO (USA). Technical Measurements Center
Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989, 15:684 (R;US)

Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia
Contribution to calculation of distribution coefficient of the Uranium using solvent extraction, 15:112 (R;BR;In Portuguese)
Solvents extraction of niobium and tantalum, 15:940 (R;BR;In Portuguese)

Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Quimica
Determination of U^{235} enrichment from nuclear fuel by neutronic activation, 15:930 (R;BR;In Portuguese)

Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik
Investigations on human blood cells for the diagnosis of radiation damage. Final report, 15:1420 (R;DE;In German)

University of Southern California, Los Angeles, CA (USA)
Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)

University of Southern California, Los Angeles, CA (USA). Center for Laser Studies
New, efficient optically pumped solid-state lasers. Final report, 15 August 1984-14 November 1988, 15:1027 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Analysis
A compendium of options for government policy to encourage private sector responses to potential climate changes: Volume 1, Methodological justification and generic policy instruments, 15:1328 (R;US)
A compendium of options for government policy to encourage private sector responses to potential climate change: Volume 2, Policy options by sector and considerations for assembling a policy package, 15:1329 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA)
INGS Pipeline Project, Tennessee Gas Pipeline Company: Environmental assessment, 15:93 (R;US)

USDOE Assistant Secretary for Nuclear Energy, Washington, DC (USA)
Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1988: Report to Congress in Response to Public Law 99-240, 15:143 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
International petroleum statistics report, 15:65 (R;US)
Monthly energy review, July 1989, 15:648 (R;US)
PC-AEO forecasting model for the Annual Energy Outlook 1989: Model documentation, 15:589 (R;US)
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
International oil and gas exploration and development activities: Second quarterly report, 15:48 (R;US)
Natural gas annual 1988: Volume 1, 15:91 (R;US)
Natural gas annual 1988: Volume 2, 15:92 (R;US)

USDOE Office of Energy Research, Washington, DC (USA)
SSC [Superconducting Super Collider] site evaluations, 15:1091 (R;US)

USDOE Richland Operations Office, WA (USA)
Grout Treatment Facility dangerous waste permit application: Engineering reports: Supplement 1, 15:146 (R;US)
Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989, 15:147 (R;US)

USDOE, Washington, DC (USA)
Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement, 15:26 (R;US)
Summary of papers to be presented at the Eleventh computer security group conference, 15:1982 (R;US)

Utah State Univ., Logan, UT (USA). Center for Space Engineering
Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Electrical Engineering
Downstream ray tracing in beam-optics codes. Final report, September 1984-September 1987, 15:1100 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Physics
Studies of the cosmic ray penumbra. Final report, 9 September 1980-30 September 1985, 15:1548 (R;US)

V

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)
Use of peat in wood adhesives, 15:16 (R;FI;In Finnish)

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Lab. of Electrical and Automation Engineering
Analysis of an R-SQUID noise thermometer. Doctoral thesis, 15:994 (R;FI)

Vanderbilt Univ., Nashville, TN (USA). Dept. of Civil and Environmental Engineering
Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report, 15:1331 (R;US)

Ventura County Environmental Health Dept., CA (USA)
Hazardous-waste-reduction guidelines for environmental-health programs, 15:724 (R;US)

Versar, Inc., Springfield, VA (USA)
Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report, 15:733 (R;US)

Virginia Electric and Power Co., Glen Allen, VA (USA)
Virginia Power's study of a Shell-based GCC [gasification combined-cycle] power plant: Final report, 15:9 (R;US)

Virginia Polytechnic Inst., Blacksburg, VA (USA). Dept. of Physics
Linking the Gauss-Bonnet-Chern theorem, essential HOPF maps and membrane solitons with exotic spin and statistics, 15:1763 (R;US)

Virginia Univ., Charlottesville, VA (USA). Div. of Urban and Environmental Planning
Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)

Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)
Intraval-project test case 5: tracer tests at Finnsjoen. Predictive modelling of the radially converging experiment, 15:179 (R;FI)

W

Warren Spring Lab., Stevenage (UK)
Calibration and quality assurance for dioxin analysis, 15:1447 (R;GB)
Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986, 15:1263 (R;GB)
United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)

Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program
Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-Wave heating: Progress report No. 3, July 16, 1988–July 15, 1989, 15:1892 (R;US)

Washington Univ., Seattle, WA (USA). Applied Physics Lab.
Environmental measurements in the Beaufort Sea, Spring 1988. Technical report, 15:1322 (R;US)

Washington Univ., Seattle, WA (USA). Coll. of Engineering
Laser-mixing processes. Final report, 1 July 1977-31 October 1978, 15:1025 (R;US)

Washington Univ., Seattle, WA (USA). Dept. of Biological Structure
Modulation of lymphopoiesis: Annual report, 15:1424 (R;US)

Washington Univ., St. Louis, MO (USA). Center for Air Pollution Impact and Trend Analysis
Trends of seasonal haziness and sulfur emissions over the eastern US, 15:1275 (R;US)

West Virginia Univ., Morgantown, WV (USA). Energy and Water Research Center
Fossil energy research program: Project status quarterly report, April 1–June 30, 1989, 15:30 (R;US)

Westinghouse Hanford Co., Richland, WA (USA)
300 Area process trench sediment analysis report, 15:1304 (R;US)
Computer-controlled flux monitoring using high-density, self-powered incore detectors, 15:458 (R;US)
Guidance on the use of fixed neutron absorbers, 15:452 (R;US)
Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989, 15:147 (R;US)
Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)
N Reactor external events probabilistic risk assessment, 15:505 (R;US)
Natural phenomena analyses, Hanford Site, Washington, 15:1319 (R;US)
Operating team training: Technical training's role, 15:478 (R;US)
Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion, 15:114 (R;US)
Seismic qualification of safety class components in existing non-reactor nuclear facilites at Hanford Site, 15:115 (R;US)
The April 1962 criticality event in the Recuplex facility, 15:174 (R;US)

Westinghouse Hanford Co., Shippingport, PA (USA). Shippingport Station Decommissioning Project Office
Completion of the Shippingport reactor decommissioning, 15:487 (R;US)
Shippingport Station Decommissioning Project: Removal of piping and equipment and removal of primary system components, 15:203 (R;US)

Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA)
The evolution of seismic design criteria at the Idaho Chemical Processing Plant, 15:1320 (R;US)
Transport properties of radionuclides and hazardous chemical species in soils at the Idaho Chemical Processing Plant, 15:175 (R;US)

Westinghouse Savannah River Co., Aiken, SC (USA)
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)
Applications of probabilistic risk assessment to criticality safety at the Savannah River Site, 15:507 (R;US)
Development and testing program update for remote cell production of Pu 239, 15:1000 (R;US)
Distributed control system-based process simulation: Revision 1, 15:177 (R;US)
Foam and gel decontamination techniques, 15:967 (R;US)
Model evaluation studies, 15:1286 (R;US)
Probabilistic evaluation of main coolant pipe break indirectly induced by earthquakes: Savannah River Project L and P Reactors, 15:506 (R;US)
Savannah River Laboratory Seepage Basins: Waste site assessment report, 15:1305 (R;US)
The DWPF Melter proposed heat up sequence, 15:178 (R;US)
Use of borosilicate glass in fissile operations at Savannah River (U), 15:897 (R;US)
Use of the linear variate method of Monte Carlo for estimating uncertainty in thermal-hydraulic codes, 15:480 (R;US)

Wisconsin Univ., Madison, WI (USA)
Theoretical reversed field pinch studies: Annual progress report, October 31, 1988–November 1, 1989, 15:1891 (R;US)

Wisconsin Univ., Madison, WI (USA). Dept. of Nuclear Engineering and Engineering Physics
Experimental investigation of ICRF effects, 15:1928 (R;US)

Woods Hole Oceanographic Institution, MA (USA)
Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis, 15:1330 (R;US)

World Wildlife Fund, Washington, DC (USA)
Executive overview of World Wildlife's conference on consequences of the greenhouse effect for biological diversity: Final project report, 15:1253 (R;US)

Writing Consultants Associated, Pittsburgh, PA (USA)
Proceedings: Reducing power plant emissions by controlling coal quality, 15:310 (R;US)

Y

Yale Univ., New Haven, CT (USA). Dept. of Mechanical Engineering
Simultaneous multipoint measurements of density gradients and temperature in a flame: Final report, August 1, 1985–July 31, 1987, 15:972 (R;US)

Z

Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

Abbassi, P., *See* Frederking, T.H.K., 15:988
Abdallah, J. Jr., *See* Clark, R.E.H., 15:1709
Abdu, M.A., Overview of the ionospheric research at INPE, 15:1620 (RA;BR)
See Batista, I.S., 15:1646
See Kantor, I.J., 15:1897
See Medrano, R.A., 15:1658
See Medrano-Balboa, R.A., 15:1659
See Muralikrishma, P., 15:1660
See Paula, E.R. de, 15:1665
See Sobral, J.H.A., 15:1667, 15:1668, 15:1669
Ablowitz, M.J., Nonlinear waves. Technical report, 15:1877 (R;US)
Abrajano, T.A. Jr., Analytical electron microscopy of leached nuclear waste glasses, 15:139 (R;US)
See Ebert, W.L., 15:138
Adamov, E.O., Physics and technology of nuclear reactors, 15:426 (R;SU;In Russian)
Adams, M.L., Synthetic acceleration of one-group S_N k-eigenvalue problems, 15:440 (J;US)
Adams, R.G., *See* Raymond, T.D., 15:1039
Adams, T.N., Kraft recovery boiler physical and chemical processes, 15:699 (B;US)
Addis, R.P., Model evaluation studies, 15:1286 (R;US)
Adler, M.V., *See* Gant, K.S., 15:1422
See Weiss, B.H., 15:482
Adler, N. de, *See* Ezquer, R.G., 15:1652
Adlhart, O.J., *See* Rosso, M.J. Jr., 15:668
Adomaitis, R.A., Numerical bifurcation analysis and parallel processing, 15:1985 (R;US)
Afonso, G.B., Interaction of dust grains with space plasmas, 15:1676 (RA;BR)
Agarwala, V, *See* Varma, R., 15:801
Agnew, J.W., *See* Horvath, S.M., 15:1274
Agostini, R.C., PLC-based interlock system for superconducting magnets, 15:1014 (J;US)
Agrawal, H.M., $^{89}Y+n$ resonances for E=10-740 keV and intermediate structure, 15:1790 (J;NL)
Agrawal, P.K., *See* Amin, M., 15:496
Ahl, T.J., *See* Amin, M., 15:496
Ahlheim, U., *See* Fraunberger, G., 15:809
Ahluwalia, R.K., Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)
Ahmad, I., Reflection asymmetric shapes in nuclei, 15:1799 (R;US)
Ahrenkiel, R.K., III-V compound process development using photoluminescence lifetime, 15:905 (BA;US)
Minority carrier lifetime of GaAs on silicon, 15:906 (BA;US)
Ultralong minority-carrier lifetime epitaxial GaAs by photon recycling, 15:907 (J;US)
Ahrens, T.J., *See* Okeefe, J.D., 15:1509
Ahsan, M.Q., *See* France, J.E., 15:88
Aine, C.J., Effects of spatial attention on the visual-evoked neuromagnetic response, 15:1402 (R;US)
Akasofu, S.I., *See* Tsurutani, B.T., 15:1639
Al-Ayat, R.A., Evaluating the contributions of material control to insider protection, 15:217 (R;US)
Al-Jassim, M.M., *See* Ahrenkiel, R.K., 15:906
Alarcon, R., Giant *M*1 resonance in ^{120}Sn and the quenching of the nucleon spin *g* factors, 15:1792 (J;US)
See Papanicolas, C.N., 15:1205
Alavi, B., *See* Hsu, L., 15:751
Albagli, D., *See* Chen, M., 15:1883
Alberty, R.A., Thermodynamics and kinetics of complex organic systems: Progress report, March 15, 1989–March 14, 1990, 15:936 (R;US)
Albright, C.H., Hierarchical chiral symmetry breaking and quark mass matrices revisited, 15:1743 (J;DE)
Aldemir, T., *See* Harunuzzaman, M., 15:411
See Hassan, M., 15:462
Aleksick, R.M., *See* Micklich, B.J., 15:545
Alem, M.C., Uranium determination in $UO_2(NO_3)_2$-HNO_3-H_2O system by precision densimetry, 15:926 (R;BR;In Portuguese)
Alexander, P.M., Equations of conservation laws in the interplanetary collisionfree plasma, 15:1677 (RA;BR)
Aljishi, S., *See* Shen, D.S., 15:902
Allegretti, D.W., *See* Sommers, G.L., 15:234
Allen, J.H., *See* Wilkinson, D.C., 15:1687
Allen, J.W., *See* Bohanick, J.S., 15:346
See Shen, Z.X., 15:1873
Allen, R.E., Capital costs for future light water reactors with modularization/standardization, 15:380 (J;US)
See Braun, C., 15:381
Allwine, K.J., *See* Whiteman, C.D., 15:1245, 15:1247
Almeida, M.C.M. de, Optimization of transmission method for using in safeguards, 15:929 (R;BR;In Portuguese)
Almeida, M.C.M. de., Determination of U^{235} enrichment from nuclear fuel by neutronic activation, 15:930 (R;BR;In Portuguese)
Aloia, J., *See* Schuchman, J.C., 15:1106
Altenkirch, R.A., *See* Vento, D.M., 15:974
Alton, G.D., Design features of an axial-geometry, plasma-sputter, heavy negative ion source, 15:1113 (R;US)
Alvala, P.C., *See* Piazza, L.R., 15:1666
Alvarez, L.W., *See* Alvarez, W., 15:1474
See Asaro, F., 15:1475
Alvarez, W., Debate over the Cretaceous-Tertiary boundary, 15:1474 (RA;US)
See Asaro, F., 15:1475
Alvarez-Madrigal, M., *See* Mendoza, B., 15:1564
See Perez-Enriquez, R., 15:1562, 15:1681
Amano, Yuji, Model study of the effects of wind on ion current density and electric field at the ground level, 15:314 (R;JP;In Japanese)
Amaral, E.C.S., *See* Azevedo, H.L., 15:201
See Vasconcellos, L.M.H., 15:200
Ambekar, S.H., *See* Apel, M.L., 15:721
Ameri, S., *See* Aminian, K., 15:55
Amin, M., An analytical study of seismic threat to containment integrity, 15:496 (R;US)
Aminian, K., CO_2 mobility control by carbonate precipitation: A feasibility study, 15:55 (B;US)
See Duda, J.R., 15:90
Amor, R.A., *See* Noto, M.G., 15:964
Analytis, G.Th., Assessment of the nearly implicit solution scheme of RELAP5/MOD2: Numerical viscosity and suppression of oscillations, 15:450 (J;US)
and others, *See* Ford, W.T., 15:1727
See Garnett, R., 15:1729

See Kebede, A., 15:851
See Letessier-Selvon, A., 15:1787
See Smith, L.C., 15:1783
See Thurston, T.R., 15:856
See Trost, L.H., 15:1728
Anderman, M., Rechargeable Li-TiS2 cells of spirally wound design, 15:571 (BA;US)
Anders, B., Operation of the cyclotron U-120, 15:1098 (RA;DD)
Anders, E., *See* Gilmour, I., 15:1480
See Wolbach, W.S., 15:1538
Anders, M.H., *See* Asaro, F., 15:1475
See Owen, M.R., 15:1511
Anderson, A.C., *See* Dilorio, M.S., 15:982
See Oates, D.E., 15:983
Anderson, C.W., [Research on the structure of the adenovirus virion]: Foreign trip report, July 9–August 1, 1989, 15:1372 (R;US)
Anderson, D.M., Geometrical aspects of the frustration in the cubic phases of lyotropic liquid crystals, 15:1382 (J;US)
See Jackson, S.M., 15:1543
Anderson, E., *See* McNulty, I., 15:1107
Anderson, J.L., *See* Bartlit, J.R., 15:1952
See Enoeda, M., 15:1950
See Ide, T., 15:1945
Anderson, K.A., Study of low-energy electrons over the polar region by using the USAF (United States Air Force) operational DMSP satellite. Final technical report, 15:1619 (R;US)
Anderson, K.B., Analysis and comparison of two Victorian Brown Coal resinite samples, 15:18 (R;US)
Anderson, R., Electrical breakdown in vacuum: Working group report, 15:997 (R;US)
Anderson, R.J., *See* Meyer, C.T., 15:35
Anderson, R.R., *See* Hartung, J.B., 15:1486
See Tsurutani, B.T., 15:1639
Anderson-Batiste, G.J., *See* Davis, S.C., 15:696
Andraka, B., *See* Fraunberger, G., 15:809
Andrew, J.F., *See* Sandenaw, T.A., 15:777
Andriamonje, S., *See* Stolterfoht, N., 15:1785
Andronenko, L.N., Axial ionization chamber for fragment detection, 15:1183 (RA;DD)
Angel, S.M., *See* Kulp, T.J., 15:1376
Anghale, S., *See* Collins, C., 15:437
See Zhang, J.G.J., 15:402
Anspaugh, B.E., Solar cell radiation handbook. Addendum 1: 1982-1988, 15:249 (R;US)
Aoki, Seiki, *See* Matsuda, Yoshiharu, 15:565
Apel, M.L., Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments, 15:721 (R;US)
Appelbaum, J., Photovoltaic power system operation in the Mars environment, 15:273 (R;US)
Appleby, A.J., A new concept for high-cycle-life LEO: Rechargeable MnO_2-hydrogen, 15:556 (RA;US)
See Srinivasan, S., 15:659
Appourchaux, T., Solar oscillations instrumentation and measurement theory, 15:1553 (RA;FR)
Aragao, R.F., Two-beam BGK solution in an inhonogeneous magnetic field, 15:1678 (RA;BR)
Aragones, J.M., *See* Martinez-Val, J.M., 15:530
Arakawa, E.T., *See* Khare, B.N., 15:1609
Arau, B.A., *See* Werthen, J.G., 15:288
Araujo, B.F. de, *See* Alem, M.C., 15:926
Araujo, J.A. de., *See* Alem, M.C., 15:926
Archuleta, J.A., *See* Clements, W.E., 15:1242, 15:1281
Areti, H., *See* Deppe, J., 15:1209
Arguelles, M.G., Diisopropyl-ida,Mebrophenyn,Iodophenyn labelled with ^{99m}Tc. Its evaluation in several biological models, 15:965 (RA;AR;In Spanish)
Arienti, M., *See* Nunno, T., 15:723
Armand, S.C., *See* Baumeister, J.F., 15:250
Armijo, J.S., *See* Roy, P., 15:670
Armini, A.J., Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989, 15:816 (R;US)
Armstrong, N.R., *See* Zavadil, K.R., 15:805
Armstrong, R.L., *See* Park, B., 15:1250
Arnett, R.C., *See* Rood, A.S., 15:1298
Arnone, G.J., *See* Brunson, G.S., 15:1805
Aronson, S.H., *See* Trampetic, J., 15:1758
Arora, R., Radiation effects on power cables for nuclear power plants, 15:454 (J;US)
Arriagada, M.A., Semiempirical model for calculating the critical frequency of F region on Concepcion, Chile, 15:1802 (RA;BR;In Spanish)
Arthur, E.D., *See* Wilson, W.B., 15:1806
See Young, P.G., 15:1776
Arthus, M.A., *See* Zachos, J.C., 15:1539
Artur, A.C., *See* Kawashita, K., 15:1471
Arueti, S., A computerized experiment for comparison between methods of uncertainty propagation, 15:461 (BA;US)
Arwood, J.W., *See* Greene, N.M., 15:141
Asada, Minoru, *See* Taniguchi, Haruhito, 15:313
Asakawa, Akira, *See* Yokoyama, Shigeru, 15:315
Asaro, F., Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions, 15:1475 (RA;US)
See Alvarez, W., 15:1474
Aselage, T.L., *See* Tallant, D.R., 15:866
Ashby, C.I.H., Carrier-lifetime control of photochemical dry etching using elevated impurity concentrations, 15:909 (J;US)
Ashery, D., *See* Smith, L.C., 15:1783
Ashkenazi-Kimmel, T., Amplification of oncogenes in early-stage, radiation-induced rat skin tumours, 15:1370 (R;US)
Asibe, B., *See* Ozoemena, P.C., 15:1663
Askins, M.C., Estimating the remanent life of boiler pressure parts: Pt. 3. A metallographic technique for life assessment of parent 1Cr1/2Mo steel, 15:761 (R;GB)
Asogwa, M., *See* Ozoemena, P.C., 15:1663
Assis, A.S. de, Coronal heating with surface waves, 15:1559 (RA;BR)
See Azevedo, C.A., 15:1560
Astruc, J.M., *See* Hoffmann, H., 15:387
Atac, R., *See* Deppe, J., 15:1209
Atencio, J.D., *See* Krick, M.S., 15:1167
Attia, A.I., A survey of advanced battery systems for space applications, 15:552 (RA;US)
The development of a new sealed bipolar lead-acid battery, 15:586 (BA;US)
Aubrey, D.R., Description of a simple fault locating device - the magnetic strip fault recorder, 15:324 (R;GB)
Auer, L.H., A source of observational constraints on the structure of Wolf-Rayet winds, 15:1569 (R;US)
Auerbach, N., Double Gamow–Teller strength in nuclei, 15:1813 (J;US)
Aunzo, Z., The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 3: Appendices F through I, 15:297 (R;US)
Austin, A.L., A study of the utilization of ex-managers, 15:1977 (R;US)
Austin, D.M., *See* Decker, J.F., 15:2005
See Lyons, L.A., 15:410
Avery, R.K., A simple domain model of flux reversal in ferrites, 15:1129 (R;US)
Awadalla, N.G., *See* Short, S.A., 15:506
Awaluddin, A., Biological evaluation of ^{99m}TC cis-Pt iminoacetic acid complexes as tumour imaging agents, 15:1396 (RA;AR)
See Maddalena, D.J., 15:962
Axelson, S.R., Preparation and evaluation of silicon nitride matrices for silicon nitride-SiC fiber composites. M.S. Thesis Final Technical Report, 15:830 (R;US)
Ayres, D.S., The soudan 2 experiment, 15:1153 (R;US)
Azevedo, C.A., Global Alfiven modes in solar physics preliminary studies, 15:1560 (RA;BR)
Azevedo, H.L., Evaluation of the ^{226}Ra transport by rivers sediments surroundings the brazilian uraniums mining and milling, 15:201 (R;BR)
Azmy, Y.Y., Artificial intelligence search techniques for the optimization of cold source geometry, 15:224 (J;US)
The weighted diamond-difference form of nodal transport methods, 15:429 (J;US)
See Kirk, B.L., 15:439
Azumi, SS., *See* Yokote, Mitsuhiro, 15:359

B

Babcock, G.T., *See* Debus, R.J., 15:1384
Babinski, M., Lead-lead dating of migmatitic rocks from the region of the Sao Jose dos Campos, Sao Paulo state, Brazil, 15:1472 (R;BR)
Baca, P.M., Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)
Bacher, P., The CAD systems for Chooz-B nuclear power plant construction, 15:369 (J;US)
Back, J.M., *See* Chen, J.R., 15:1212
Backus, C.E., *See* Joardar, K., 15:290
Badjukov, D.D., *See* Kolesnikov, E.M., 15:1494
Badruzzaman, A., Discrete ordinates methods for radiation transport, 15:473 (R;US)
Badshah, M.G.Q., *See* Arora, R., 15:454
Bailey, S.A., Calibration of a photomultiplier array spectrometer, 15:1172 (R;US)
Bailey, S.G., The GaAs solar cells with V-grooved emitters, 15:251 (R;US)
See Landis, G.A., 15:248
Bailey, T.L., *See* Berg, R.M., 15:339
Baillie, C.F., A new MCRG [Monte Carlo Renormalization Group] calculation of the critical behavior of the 3d ising model - preliminary results, 15:1878 (R;US)
Baird, B., An OPS5-english english-OPS5 parser and language generator, 15:2001 (BA;US)
Baker, A., *See* Castro, M., 15:287
Baker, C., *See* Ballard, E.O., 15:1947
Baker, E.D., TA705 Data Retention Chassis operating manual, 15:1075 (R;US)
Baker, E.G., *See* Elliott, D.C., 15:254
Baker, J.R., Macrotasking the singular value decomposition of block circulant matrices on the Cray-2, 15:1989 (R;US)
Baker, K.D., *See* Ulwick, J.C., 15:1615
Baker, P.S., *See* Dearborn, L.L., 15:1296
Baker, S.S., *See* Warren-Hicks, W., 15:1353
Balachandran, U., Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Balasubramanian, K., Geometries and energy separations of 14 electronic states of Au_4, 15:1715 (J;US)
Baldwin, R., Hydrogen-oxygen proton-exchange membrane fuel cells and electrolyzers, 15:661 (RA;US)
Baleynaud, J.M., Contribution to the modelling of passive solar buildings. Validation and study of the sensitivity factors, 15:283 (R;FR;In French)
Ballard, E.O., CPRF/ZTH front-end torus design and fabrication status, 15:1947 (R;US)
See Reass, W.A., 15:1949
Bando, A., *See* Fox, J., 15:1255
Bandyopadhyay, P.K., *See* Studier, F.W., 15:1381
Banghart, E.K., The effects of high level injection on the performance of high intensity, high efficiency silicon solar cells, 15:269 (BA;US)
Bankston, C.P., *See* Distefano, S., 15:554
See Ratnakumar, B.V., 15:572
Baptista, H., *See* Almeida, M.C.M. de, 15:929
Bar-Shalom, A., Super-transition-arrays: A model for the spectral analysis of hot, dense plasma, 15:1915 (J;US)
Baranoski, M.T., Analysis of stratigraphic and production relationships of Devonian-shale gas reservoirs in Ohio. Final report, October 1985-November 1988, 15:86 (R;US)
Baraona, C.R., *See* Winslow, C., 15:247
Barboux, P., *See* Jorgensen, J.D., 15:1869
Barish, K.N., *See* Baillie, C.F., 15:1878
Barkatt, A., *See* Feng, X., 15:196
Barker, L., *See* Agostini, R.C., 15:1014
Barker, L.M., Solving the blow-by problem in a two-stage gun, 15:996 (R;US)
Barker, P.F., *See* Wise, S.W., 15:1537
Barney, D.M, Contained radiological analytical chemistry module, 15:1349 (P;US)
Barr, S., Influence of external meteorology on nocturnal valley drainage winds, 15:1287 (J;US)
Barraclough, J.T., *See* Rood, A.S., 15:1298
Barrand, R.D., *See* Mulpuru, S.R., 15:519
Barrick, R., Briefing report to the EPA (Environmental Protection Agency) Science Advisory Board: The apparent effects threshold approach. Briefing report (Final), 15:1335 (R;US)
Barry, B.A., *See* Debus, R.J., 15:1384
Barsoum, M., *See* Koczak, M.J., 15:890
Barss, N.M., *See* Micklich, B.J., 15:545
Bartel, L.C., Results from electromagnetic surface surveys to characterize the Culebra aquifer at the WIPP [Waste Isolation Pilot Plant] site, 15:170 (R;US)
Barth, R.F., *See* Mengers, T.F., 15:1406
Bartholomew, C.H., Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988–December 15, 1988, 15:6 (R;US)
Bartholomew, G.A., *See* Lighton, J.R.B., 15:1410
Bartlett, R.W., Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)
Bartlett, T.F., *See* Geesaman, D.F., 15:1134
Bartlit, J.R., Dispersion and removal of tritium released into the main cell TSTA [Tritium Systems Test Assembly], 15:1952 (R;US)
See Enoeda, M., 15:1950
See Ide, T., 15:1945
Bartok, W., Gas reburning-sorbent injection for controlling SO_{chl} and NO_{chl} utility boilers, 15:312 (B;US)
Bartynski, R.A., Photoelectron diffraction determination of the geometry of a clean metal surface: Ta(100), 15:811 (J;US)
Barua, A.K., *See* Tsuo, Y.S., 15:900
Bass, M., New, efficient optically pumped solid-state lasers. Final report, 15 August 1984-14 November 1988, 15:1027 (R;US)
Bassi, J., Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report, 15:733 (R;US)
Bastos, M.B.R., Determination of uranium (IV) in cloride solutions of enrichment columns by spectrometry with flow injection, 15:924 (R;BR;In Portuguese)
Batchelor, D.B., *See* Carter, M.D., 15:1926
Bates, F.S., *See* Wignall, G.D., 15:874
Bates, J.K., Identification of secondary phases formed during unsaturated reaction of UO_2 with EJ-13 water, 15:958 (R;US)
Parametric effects of glass reaction under unsaturated conditions, 15:872 (R;US)
See Abrajano, T.A. Jr., 15:139
See Ebert, W.L., 15:138
Bathke, C.G., Vertical stability requirements for ARIES-I reactor, 15:1901 (R;US)
See Peng, Y.K.M., 15:1888
Batista, I.S., Magnetic activity effects on range type spread-F and vertical plasma drifts at Fortaleza and Huancayo from ionosonde measurements, 15:1646 (RA;BR)
See Batista, P.P., 15:1647
See Medrano, R.A., 15:1658
See Medrano-Balboa, R.A., 15:1659
See Muralikrishma, P., 15:1660
Batista, P.P., Long-term laser radar observation of sporadic sodium layers at 23^0S: a correlative and statistical study, 15:1647 (RA;BR)
See Gobbi, D., 15:1655
Batistic, I., *See* Gammel, J.T., 15:1872
Batte, G.L., *See* Pahl, R.G., 15:392
Bauer, M.L., *See* Chiles, M.M., 15:1160
Baughman, K.W., *See* Finkel, J.M., 15:25
Baum, R.M., Synchrotron radiation sources to provide new probes of matter, 15:223 (J;US)
Baumeister, J.F., Comparative thermal analysis of the space station Freedom photovoltaic deployable boom structure using TRASYS, NEVADA, and SINDA programs, 15:250 (R;US)
Bauschlicher, C.W. Jr., On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)
Recent advances in electronic structure theory and their influence on the accuracy of ab initio potential energy surfaces, 15:944 (R;US)
Baxter, J.T., N Reactor external events probabilistic risk assessment, 15:505 (R;US)
Baxter, L.L., *See* Smith, P.J.Q., 15:34

Bazhenov, A.V., Infrared reflectivity spectra of single crystals of La_2CuO_4, 15:850 (J;US)
Beach, D.E., *See* Baumeister, J.F., 15:250
Beahm, E.C., Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)
Beatty, R.L., [Advanced ceramics for fusion applications]: Foreign trip report, June 17, 1988–June 25, 1988, 15:1965 (R;US)
Beaudreau, J.J., Evaluation of erbia as a burnable absorber in a 24-month, low-leakage C-E core, 15:362 (J;US)
Beauregard, R.J., Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)
Beavis, D., A calorimeter for relativistic heavy-ion experiments, 15:1203 (J;NL)
Becher, P.F., [7th international conference on ceramics]: Foreign trip report, December 12–18, 1988, 15:835 (R;US)
Beckham, P.E., *See* Groff, C.R., 15:371
Beckman, W.L., Upgrading radiological work practices through employee participation, 15:365 (J;US)
Bedi, J.F., *See* Horvath, S.M., 15:1274
Beebe, T., *See* Ogletree, D.F., 15:781
Beech, J.C., Thermal performance of lightweight inverted warm deck flat roofs, 15:674 (R;GB)
Begemann-Blaich, M.L., *See* Fowler, M.M., 15:1207
Behrens, U., Experimental investigations of the sensitivity of hydrogen-steam-air mixtures with regard to the deflagration-detonation transition, 15:481 (R;DE;In German)
Beltz, J.V., Laser-induced flourescence studies of Cm^{3}+ complexes in solution, 15:873 (R;US)
Bekefi, G., Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988, 15:1021 (R;US)
Belkus, P., *See* Torbin, R.N., 15:100
Bell, M.J., Status of the NRC's high-level waste repository licensing program, 15:190 (J;US)
Bell, R.M., *See* Meacham, J.A., 15:1216
Beller, H., *See* Barrick, R., 15:1335
Bellis, V.M. de., Addition compounds between lanthanide trifluoromethane sulphonates and N,N,N',N' - tetrametilmalonamida (TMMA), 15:928 (R;BR;In Portuguese)
Bellon, M., *See* Remy, F.N., 15:378
Beltranda, G., *See* Bacher, P., 15:369
Ben-Shacher, B., *See* Hoffman, J.M., 15:1846
Benda, G.J., Third-party financing option, 15:640 (RA;US)
Benesh, C.J., Single nucleon removal in relativistic nuclear collisions, 15:1819 (J;US)
Benet, P., *See* Ahmad, I., 15:1799
Bengtson, G., *See* Boeddeker, K.W., 15:938
Bengtsson, H., Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?, 15:1751 (J;US)
Benner, R.E., 1000-fold speedup of scientific computations on a 1024 processor hypercube, 15:2000 (B;US)
Bennett, F.L., *See* Zarling, J.P., 15:1414, 15:1415
Bennett, G.A., Rf transistor thermal/electrical characterization, 15:1073 (R;US)
Bennett, R.G., Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)
Bentley, J., [Future of electron microscopy]: Foreign trip report, September 11–30, 1989, 15:792 (R;US)
Bents, D.J., Estimated performance and future potential of solar dynamic and photovoltaic power systems for selected LEO and HEO missions, 15:274 (R;US)
Benz, W., *See* Cameron, A.G. W., 15:1607
Beret, S., Effect of prehydrogenation on hydroconversion of Maya residuum, part II: Hydrogen incorporation, 15:62 (B;US)
Berg, D., A real time integrated environment for Motorola 680chichi-based VME and FASTBUS modules, 15:1140 (J;US)
See Petravick, D., 15:1135
Berg, R.M., Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)
Berge, J.P., *See* Trost, L.H., 15:1728
Berger, E.L., Phenomenology of heavy quark production, 15:1732 (R;US)
Berger, G., *See* Chirila, J.V., 15:694
Berleze, S.M., *See* Afonso, G.B., 15:1676
Berlow, J.R., Best demonstrated available technology (BDAT) background document for K099 (non CBI version). Final report, 15:1351 (R;US)
Berman, B.L., *See* Kephart, J.O., 15:1862
Berman, E., *See* Petravick, D., 15:1135
Berman, E.F., *See* Petravick, D.L., 15:2010
Berman, M., A critique of three methodologies for estimating the probability of containment failure due to steam explosions, 15:539 (J;US)
See Young, M.F., 15:510
Bernard, J.A., An examination of expert systems activities within the nuclear industry, 15:469 (J;US)
Inverse dynamics and the hybrid method of reactivity measurement, 15:438 (J;US)
See Washio, T., 15:464
Bernard, V., Electromagnetic polarizabilities of pseudoscalar Goldstone bosons, 15:1756 (J;US)
Bernardez, L., *See* Peng, J.L., 15:853
Bernett, M., Uniform communications software using TCP/IP, 15:1139 (J;US)
See Petravick, D., 15:1135
See Pordes, R., 15:1133
Bernstein, A.M., *See* Papanicolas, C.N., 15:1205
Bernstein, I.B., *See* Susskind, S.M., 15:1696
Berry, F.C., Development of parallel algorithms for electrical power management in space applications, 15:330 (RA;US)
Berry, G.F., *See* Chang, S.L., 15:1087
Berry, W. B. N., Late Wenlock (middle Silurian) bio-events: Caused by volatile boloid impact/s, 15:1476 (RA;US)
Bers, A., *See* Ram, A.K., 15:1906
Bertault, D., *See* Stolterfoht, N., 15:1785
Beshears, D.L., *See* Muhs, J.D., 15:871
Betts, R.R., *See* Beavis, D., 15:1203
Bezerra, J.H.B., *See* Almeida, M.C.M. de, 15:929
Bhargava, A.K., *See* Zabot, S., 15:281
Bhat, B.N., Cryogenic turbopump bearing materials, 15:985 (RA;US)
Bhatnagar, S.K., Simplified determination of radiation environment outside BSW penetrations, 15:543 (J;US)
Bhattacharya, P.K., *See* Oh, J.E., 15:885, 15:886
Bhattacharya, S.K., *See* Herman, Y., 15:1495
Bickes, R.W. Jr., *See* McCampbell, C.B., 15:1223
Bidelman, W.P., Publications of the Observatory of the University of Michigan. Volume 12, no. 2: Wavelength identifications in the magnetic CP star HR 4816 (HD 110066), 15:1605 (B;US)
Biedermann, M., HOT - a Fortran program for calculation of fast nucleon emission from a hot zone, 15:1810 (RA;DD)
PEP (promptly emitted particles) - a Fortran program for calculation of fast nucleon emission in heavy-ion reactions, 15:1809 (RA;DD)
Biefeld, R.M., *See* Ashby, C.I.H., 15:909
Biel, J., *See* Deppe, J., 15:1209
Bielschowsky, C.A., *See* Robert, H.M.B., 15:1557
Bienvenu, C., Turning point in the study of human factors: From centurion to modern man, 15:414 (J;US)
Bierman, S.R., Reactivity measurements on an experimental assembly of 4.31 wt % ^{235}U enriched UO_2 fuel rods arranged in a shipping cask geometry, 15:128 (R;US)
Bigelow, T.S., *See* Neilson, G.H., 15:1889
Bilger, K., *See* Winslow, C., 15:247
Billquist, P.J., *See* Pardo, R.C., 15:1112
Binney, S.E., Application of PCs to a nuclear reactor laboratory course, 15:431 (J;US)
Birgeneau, R.J., *See* Thurston, T.R., 15:856
See Yamada, K., 15:855
Birklid, C.A., *See* Zarling, J.P., 15:1415
Birklind, C.A., *See* Zarling, J.P., 15:1414
Birnbaum, M., *See* Bass, M., 15:1027
Bischof, C.H., A block QR factorization algorithm using restricted pivoting, 15:1984 (R;US)
Bischoff, F.G., *See* Brown, F.B., 15:444
Bishop, A.R., *See* Gammel, J.T., 15:1872
See Mazor, A., 15:1867
Bittencourt, J.A., Low-latitude F-region dynamical processes from atomic oxygen nightGlow emissions, 15:1648 (RA;BR)

Bixler, N.E., Drying of permeable media: Whitaker's paradox explained, 15:1060 (BA;US)
Bjorklund, E.A., *See* Howell, J.A., 15:1095
Black, R.D., *See* Ferro, P.D., 15:305
Blackburn, J.B., *See* Miller, C.W., 15:526
Blahnik, D.E., LWR spent-fuel radiochemical measurements and comparison with ORIGEN2 predictions, 15:184 (J;US)
Blaich, T., *See* Fowler, M.M., 15:1207
Blais, N.C., Detonation chemistry studies of energetic materials using laboratory scale samples, 15:1221 (R;US)
Blakeman, E.D., *See* Mihalczo, J.T., 15:1007
Blanc, E., Nonlinear wave fronts and ionospheric irregularities observed by HF sounding over a powerful acoustic source, 15:1690 (J;US)
Blanchard, R., *See* Moore, J., 15:1840
Blass, J.J., [Structural design criteria for HTGR reactors]: Foreign trip report, January 28, 1989–February 5, 1989, 15:385 (R;US)
Bleecker, A.B., Regulation of ethylene biosynthesis in plants; properties of ACC synthase, 15:1369 (RA;US)
Bleher, S., Routes to chaotic scattering, 15:1744 (J;US)
Bleier, A., [Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988, 15:832 (R;US)
Bliem, C.J., Geothermal heat cycle research supercritical cycle with counterflow condenser in different orientations, 15:296 (R;US)
Blomquist, R.N., *See* Gelbard, E.M., 15:449
Bloom, I., Glass electrolytes and some of their applications, 15:550 (RA;US)
Bloom, S.H., *See* Kebede, A., 15:851
Bloomer, M.A., *See* Beavis, D., 15:1203
Bloomfield, H.S., *See* Hickman, J.M., 15:272
See Mckissock, B.I., 15:400
Bloyd, C., *See* Fox, J., 15:1255
Blue, T.E., *See* Mengers, T.F., 15:1406
See Wang, C.K., 15:1202
Blum, S., Post-construction activities; Passive and hybrid solar low energy buildings: Design information booklet number eight, 15:685 (R;US)
Blunden, P.G., New comparisons of the coupled-channel model with elastic deuteron form factors, 15:1827 (J;US)
Board, M., UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)
Boatner, L.A., Lead iron phosphate glass as a containment medium for disposal of high-level nuclear waste, 15:197 (P;US)
Boccio, J.L., [Development of risk-based safety indicators]: Foreign trip report, July 1, 1989–July 9, 1989, 15:486 (R;US)
Boden, T.A., *See* Jones, P.D., 15:1239
Bodvarsson, G.S., *See* Aunzo, Z., 15:297
Boeddeker, K.W., Selective pervaporation of organics from water, 15:938 (R;DE)
Boede, W., *See* Reichel, P., 15:1176
Boenig, H.J., Design and construction status of the energy system for the ZTH experiment, 15:1960 (R;US)
Design of the Los Alamos generator installation, 15:1961 (R;US)
Boeniger, M., Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Boes, E.C., A summary of recent photovoltaic concentrator technology developments, 15:286 (BA;US)
Boettger, H., ISOPLOT 2 - a program for graphic representation of functions Z = F(X,Y), 15:1812 (RA;DD)
Bogaty, J.M., *See* Den Hartog, P.K., 15:1090
Bohanick, J.S., Rotating machinery surveillance system reduces plant downtime and radiation exposure, 15:346 (J;US)
Bohn, C.L., *See* Delayen, J.R., 15:859
Bohor, B.F., Shocked quartz and more: Impact signatures in K-T boundary clays and claystones, 15:1477 (RA;US)
Boissevain, J.A., *See* Fowler, M.M., 15:1207
Boich, W.E., *See* Wright, H.A., 15:1423
Boley, M.S., *See* Shi, D., 15:862
Bollinger, L.M., *See* Den Hartog, P.K., 15:1090
Bond, V.P., [The hematopoietic stem cell]: Foreign trip report, September 27–October 11, 1989, 15:1389 (R;US)
Bond, W.D., *See* Caudill, H.H., 15:917
Bonelli, E., F-region bubbles: effects of vertical plasma drifts, 15:1649 (RA;BR)
Bonhomme, N., *See* Gozal, A., 15:377
Boni, P., *See* Graf, H.A., 15:808
Boniface, J., Irradiation of superheated superconducting tin granules with low energy photons, at temperatures below 1 k, 15:776 (R;FR)
Bonsignore, P.V., *See* Coleman, R.D., 15:698
Boonraksa, C., *See* Fingleton, D.J., 15:1317
Booser, E.R., Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
Boparai, A., The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)
Boretti, A.A., Accuracy and efficiency of a time marching approach for combustor modeling, 15:971 (RA;FR)
Borg, A., *See* Lindberg, P.A.P., 15:847
See Shen, Z.X., 15:1873
Borland, M., *See* Kramer, S.L., 15:1141
Born, K.D., 24×12^3 vs 16×8^3 lattices: Controlling finite-size effects in lattice SU(2) including fermions, 15:1772 (J;US)
Bornstein, I., The American Nuclear Society's international student exchange program, 15:435 (J;US)
Boroski, W.N., Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 1, Instrumentation and experimental preparation (300K–80K), 15:1122 (R;US)
See Gonczy, J.D., 15:1123, 15:1124
Boshoven, J.K., Inherent criticality safety margins in spent fuel transportation casks, 15:126 (R;US)
Boston, P.J., Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)
Botto, R.E., *See* Anderson, K.B., 15:18
See Winans, R.E., 15:19
Boucenna, A., Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)
Bouchacourt, M., *See* Remy, F.N., 15:378
Boudreaux, C.P., *See* Johnson, F.T., 15:372
Bouillard, J.X., On the erosion of heat exchanger tube banks in fluidized bed combustors, 15:1086 (BA;US)
See Lyczkowski, R.W., 15:1088
Bourhaleb, H., Study and Experiments of a solar energy system with air collector, underground heat storage and recovery with a heat pump, 15:284 (R;FR;In French)
Bourne, D.W., *See* Awaluddin, A., 15:1396
Bourret, S.C., *See* Rinard, P.M., 15:151, 15:215
Bove, D.J., Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)
Bowers, H.I., *See* Delene, J.G., 15:350
Bowick, M.J., Research program in elementary particle theory: Outstanding junior investigator program: Progress report for period ending December 31, 1989, 15:1766 (R;US)
Bowman, D.R., Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
Bowman, R.C. Jr., Raman and RBS studies of ion implanted semiconductors, 15:869 (R;US)
Bownds, J.M., *See* Lee, R.R., 15:1302
Boyd, D.W., *See* Awaluddin, A., 15:1396
Boyd, G., *See* Fox, J., 15:1255
Boyd, S.R., *See* Gilmour, I., 15:1481
Boynton, W.V., *See* Hildebrand, A.R., 15:1488
Bozoian, M., *See* Wilson, W.B., 15:1806
See Young, P.G., 15:1776
Bracker, S., *See* Constanta-Fanourakis, P., 15:1136
Bradley, D.J., Spent fuel performance in geologic repository environments, 15:168 (R;US)
Bradley, J.P., *See* Abrajano, T.A. Jr., 15:139
Brady, M.C., Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)
See England, T.R., 15:1797, 15:1798

Bramble, J.H., The construction of preconditioners for elliptic problems by substructuring, IV, 15:2002 (J;US)
Brandes, S.D., *See* Graff, R.A., 15:4
Brandhorst, H.W. Jr., Challenges for future space power systems, 15:275 (R;US)
InP (Indium Phosphide): Into the future, 15:246 (R;US)
Braun, C., Economic goals for the ALWR and sensitivity to cost parameters, 15:381 (J;US)
Bravo, S., Failed connexion between flares and geomagnetic storms, 15:1679 (RA;BR)
Relation between auroras observed below or at λ_{inv}=62 and polar coronal holes area, 15:1650 (RA;BR)
Breckenridge, N.J., Combustion engineering nuclear plant performance trends, 15:379 (J;US)
Brennan, K.M., *See* Lo, E.H., 15:1435
Brennan, T.M., *See* Vawter, G.A., 15:1040
Brereton, S.J., Development of the passive safety concept for ITER, 15:1932 (R;US)
Breton, M., *See* Nunno, T., 15:723
Brewer, J.C., Characterization testing of a 40 Ahr bipolar nickel hydrogen battery, 15:557 (RA;US)
Brewer, O., A graphics tool to aid in the generation of parallel FORTRAN programs, 15:1986 (R;US)
Brian, R., Fabrication of solid oxide fuel cell by electrochemical vapor deposition, 15:672 (P;US)
Briant, V.S., Expanding the human-machine interface model to address the effect of leadership and management on performance, 15:408 (J;US)
Improving implementation of corrective actions through a new management consensus process, 15:409 (J;US)
Bridges, J., *See* Nicholls, G., 15:1110
Briggs, J.B., Criticality safety margins provided by moderator control in the TMI-2 dry storage cask, 15:490 (R;US)
Briggs, L.L., A new balance-of-plant model for the SASSYS-1 LMR systems analysis code, 15:391 (R;US)
Brill, J., *See* Miller, L., 15:559
Brinca, A.L., *See* Tsurutani, B.T., 15:1639
Brinker, D.J., On-orbit results of the LIPS 3/InP homojunction solar cell experiment, 15:252 (R;US)
See Hart, R.E. Jr., 15:268
Brinkley, K.L., Materials Division research and technology accomplishments for FY 87 and plans for FY 88, 15:782 (R;US)
Brissenden, R.J., *See* Smith, N.R., 15:1005
Britt, H.C., *See* Fowler, M.M., 15:1207
Britton, D.L., Performance of lightweight nickel electrodes, 15:579 (BA;US)
Brixner, L.H., *See* Hu, B., 15:1857
Broadway, J., *See* Moore, J., 15:1840
Brocius, W.F., *See* Nellis, W.J., 15:800
Brodsky, M.B., Magnetic and electrical properties, 15:762 (R;US)
See Mattson, J., 15:764
Brommer, K.D., *See* Nagele, J.W., 15:1882
Brown, C.H., *See* Hall, R., 15:140
Brown, C.L., The April 1962 criticality event in the Recuplex facility, 15:174 (R;US)
Brown, C.M., Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)
See Ekberg, J.O., 15:1042
See Feldman, U., 15:1044
Brown, F.B., Computational geometry for reactor applications, 15:444 (J;US)
Brown, K.R., Conversion and standardization of US university reactor fuels using LEU, status 1989, 15:475 (R;US)
Brown, M.A., *See* Schweitzer, M., 15:653
Brown, P.A., *See* Schultz, D.E., 15:1126
Brown, P.W., *See* Sommers, G.L., 15:234
Brownawell, B.J., Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis, 15:1330 (R;US)
Browse, J., *See* Kunst, L., 15:1380
Broyde, S., Conformations of DNA modified by aromatic amines: Minimized semiempirical potential energy calculations and model building, 15:1375 (BA;US)
Bruhn, D.F., *See* Ward, T.E., 15:7
Bruhns, O.T., Constitutive modelling in the range of inelastic deformations, 15:771 (R;FR)
Bruins, R.J.F., Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)
Brule, M., *See* Harkness, A.C., 15:570
Brumitt, B., *See* Mattson, J., 15:764
Brun, T.O., *See* Liu, Liwen, 15:875
See Said, M.R., 15:876
Brundage, R.T., Time resolved fluorescence line narrowing in ytterbium-doped inorganic glasses, 15:903 (BA;US)
Bruno, J., *See* Grambow, B., 15:183
Brunson, G.S., A new system for analyzing neutron multiplicities: Characterization and some specific applications, 15:1805 (R;US)
Bryant, W.R., *See* Wise, S.W., 15:1537
Bryce, R.N., *See* Sherwood, D.R., 15:1341
Bryce, R.W., *See* Reiger, J.T., 15:167
Brynjolfsson, A., Uses of irradiation for inactivation of microorganisms, 15:1439 (J;US)
Buchanan, D.N.E., *See* Wertheim, G.K., 15:813
Buchanan, R.C., *See* Davison, W.W., 15:817
Buck, W.W., *See* Wilson, J.W., 15:1740
Buddemeier, R.W., Hydrology and radionuclide migration at the Nevada Test Site, 15:171 (R;US)
Buehlmann, E.T., Rotor instability due to a gear coupling connected to a bearingless sun wheel of a planetary gear, 15:304 (RA;US)
Buenerd, M., *See* Furget, C., 15:1724
Buerger, W., Operation of the electrostatic accelerators in 1985, 15:1099 (RA;DD)
Bugnet, B., Improved nickel electrodes for high temperatures, 15:582 (BA;US)
Bullington, V.R., *See* Tennery, V.J., 15:831
Bulmer, D., *See* Ward, T.E., 15:7
Bultman, D.H., 2000 MCM electrical power jumper cable with controlled flexibility: Design and life cycle test, 15:1954 (R;US)
Bunker, B.C., Superconductor precursor mixtures made by precipitation method, 15:1016 (P;US)
Bunker, S.N., *See* Armini, A.J., 15:816
Bunker, S.S., *See* Addis, R.P., 15:1286
Burckle, L.H., *See* Wise, S.W., 15:1537
Burke, K., *See* Sharpton, V.L., 15:1523
Burnham, A.K., Energy and Technology Review, September 1989, 15:631 (R;US)
See Sweeney, J.J., 15:107
Burns, F.J., The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990, 15:1425 (R;US)
Burns, P.J., Vectorization of Monte Carlo particle transport: An architectural study using the LANL benchmark "GAMTEB", 15:1988 (R;US)
Burnside, R.G., *See* Sobral, J.H.A., 15:1668
Burton, S.R.M., Improved method for determination of helium-4 in helium-3 by mass spectrometry. Report of Investigations/1989, 15:933 (R;US)
Buschmann, H., Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report, 15:1421 (R;DE;In German)
Bush, L.L., Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)
Bushaw, B.A., *See* Janik, G.R., 15:1706
Buss, R.J., *See* Ho, P., 15:845
Bustamante, P.L., *See* Loach, P.A., 15:241
Butler, C.S., SDI (Strategic Defense Initiative): Shield or sword. Study Project, 15:2012 (R;US)
Butler, M.A., Optical fiber sensor technique for strain measurement, 15:1078 (P;US)
Butner, R.S., *See* Elliott, D.C., 15:254
Buttemer, D., *See* Flanagan, G.F., 15:484
Bych, K.H., *See* Groff, C.R., 15:371
Bystricky, J., *See* Letessier-Selvon, A., 15:1787

C

Cadena, F., Evaluation of VOC (volatile organic compound) emissions from landfarming operations, 15:1254 (R;US)

Cadwallader, L.C., 1989 failure rate screening data for fusion reliability and risk analysis, 15:1930 (R;US)

A comparison of U.S. and European methods for accident scenario, identificaton, selection and quantification, 15:1936 (R;US)

Identification and selection of initiating events for experimental fusion facilities, 15:1937 (R;US)

Cadwell, L.L., *See* Eberhardt, L.E., 15:166

Caffrey, A.J., High pressure deuterium-tritium gas target vessels for muon-catalyzed fusion experiments, 15:1884 (R;US)

Cakanic, P., *See* Duarte, D.S., 15:1000

Calalo, R.H., Hypercube matrix computation task. Report, 1986-1988, 15:1830 (R;US)

Caldwell, R.B., *See* Lott, J.A., 15:1077

Callow, R.A., *See* Fink, R.K., 15:460

Calvin, M., *See* Taylor, S.E., 15:226

Cameron, A.G. W., The strange density of Mercury - Theoretical considerations, 15:1607 (BA;US)

Cameron, G.N., *See* Scheld, H.W., 15:647

Camins, I., *See* Kulp, T.J., 15:1376

Cammarata, V., *See* Chen, M., 15:1883

Camp, A.L., The role of NUREG-1150 in accident management, 15:520 (J;US)

Campbell, A.N., *See* Tallant, D.R., 15:866

Campbell, D.K., *See* Loh, E.Y., 15:1852

Campbell, E.M., *See* Drake, R.P., 15:1916

Campbell, R.B., *See* Meier, D.L., 15:260

Camporesi, T., *See* Ford, W.T., 15:1727

Canellas, C.O., *See* Arguelles, M.G., 15:965

See Mitta, A.E.A., 15:961

Cannon, B.D., *See* Janik, G.R., 15:1706

Cannon, J.N., *See* Kramer, S.K., 15:20

Cantor, C.R., High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 3. Effect of electrical field shape, 15:1387 (J;US)

See Mathew, M.K., 15:1385, 15:1386, 15:1388

Capots, L., *See* Kaschmitter, J., 15:1997

Capps, G.J., *See* Muhs, J.D., 15:871

Carbajo, J.J., Considerations for severe-accident management strategies in a pressurized water reactor, 15:521 (J;US)

Cardman, L.S., *See* Papanicolas, C.N., 15:1205

Carey, W.E., *See* Mengers, T.F., 15:1406

Carier, R.F., *See* Foley, R.D., 15:1311

Carlile, D.W., *See* Eberhardt, L.E., 15:166

Carlson, B.C., A table of elliptic integrals: Cubic cases, 15:2004 (J;US)

Carlson, R.D., US Department of Energy Laboratory Accreditation Program for personnel dosimetry systems (DOELAP), 15:1839 (R;US)

Carlson, R.R., *See* Bove, D.J., 15:624

Carlson, R.V., Tritium handling safety and operating experience at the Tritium Systems Test Assembly, 15:1951 (R;US)

See Bartlit, J.R., 15:1952

Carlson, V., *See* Garnett, R., 15:1729

Carlsson, A.E., *See* Schweika, W., 15:1865

Carmel, M.K., Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)

Caro, R.A., *See* Mitta, A.E.A., 15:961

See Rivera, E.S., 15:1399

See Rubio, M.C., 15:1398

Carpenter, G.S., *See* Jackson, S.M., 15:1543

Carpenter, M.P., *See* Ahmad, I., 15:1799

Carpenter, R., *See* Fingleton, D.J., 15:1317

Carpenter, R.A., *See* Cirillo, R.R., 15:1297

Carr, G.P., Emulating conventional operator interfaces on window based workstations, 15:1148 (R;US)

Carr, J.S., Near-infrared spectroscopy of young stellar objects. Ph.D. Thesis, 15:1606 (B;US)

Carr, M.J., *See* Casey, W.H., 15:1546

Carreras, B.A., *See* Lyon, J.F., 15:1013

See Neilson, G.H., 15:1889

Carrier, R.F., *See* Foley, R.D., 15:1312

Carroll, J., *See* Letessier-Selvon, A., 15:1787

Carruthers, P., *See* Sarcevic, I., 15:1771

Carswell, R.W., Total organizational team building at the V.C. Summer Nuclear Station, 15:363 (J;US)

Carter, J.C., *See* Carbajo, J.J., 15:521

Carter, M.D., Electron heating and static sheath enhancement in front of energized rf antennas, 15:1926 (R;US)

Carter, N.L., *See* Huffman, A.R., 15:1490

Casey, W.H., Crystal defects and the dissolution kinetics of rutile, 15:1546 (J;US)

Cassidy, L.D., *See* Mitchell, A.C., 15:1604

Castro, M., Evaluation of the SOLAR ONE and CESA-I experimental receiver and storage systems, 15:287 (BA;US)

Cates, M.R., *See* Muhs, J.D., 15:871

Caudill, H.H., Conversion of enriched isotopes of sulfur from SF_6 to a suitable compound for feed to the electromagnetic calutron separators, 15:917 (R;US)

Caudill, L.D., *See* Schrank, L.S., 15:1955

Caughman, J.B.O. II, Experimental evidence of increased electron temperature, plasma potential, and ion energy near an ICRF antenna Faraday shield, 15:1925 (R;US)

Caurier, E., *See* Drozdz, S., 15:1879

Caviglia, D.A., *See* Noto, M.G., 15:964

Cecatto, J.R., *See* Sawant, H.S., 15:1566

Cerdan, J.L., A phenomenological model of the classical thermal creep curve, 15:394 (J;US)

Cereb, N., *See* Spielberg, H., 15:1417

Ch ang, Lan-Yang, *See* Yang, Wen K., 15:1368

Chaboche, J.L., *See* Bruhns, O.T., 15:771

Chadwick, M.B., *See* Marcinkowski, A., 15:1793

Chakoumakos, B.C., Characterization and superconducting properties of phases in the Bi-Sr-Cu-O system, 15:844 (J;US)

Chakraborty, A., Magnetic ordering in $La_2Cu_{1-x}Zn_xO_{4-y}$, 15:865 (J;US)

Challinor, D., Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report, 15:1390 (R;US)

Chambers, R., Depressurization to mitigate direct containment heating, 15:522 (J;US)

Chambre, P.L., *See* Isayama, Y., 15:156

Chamis, C.C., Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)

Chan, J.W., 4.2 K fracture toughness of 304 stainless steel in a magnetic field, 15:780 (R;US)

See Morris, J.W. Jr., 15:779

Chan, S.-K., Theory of the energetics and nonclassical nucleation for martensitic transformations from partially soft lattice modes, 15:767 (R;US)

Chan, T.F., Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)

Chandler, M.C., Use of borosilicate glass in fissile operations at Savannah River (U), 15:897 (R;US)

Chang, D.B., Compact short-wavelength free-electron laser, 15:1041 (J;US)

Chang, M.C., *See* Loach, P.A., 15:241

Chang, O.K., Lithium rechargeable cells using inorganic electrolytes, 15:569 (BA;US)

Chang, R.R., Sodium sulfur battery flight experiment definition study, 15:561 (RA;US)

Chang, S.L., Spectral analysis of dynamics in fluidized bed tube banks, 15:1087 (BA;US)

See Lyczkowski, R.W., 15:1088

Chang, Y.A., *See* Li, N.N., 15:700

Chao, E.C.T., *See* Chen, J.R., 15:1212

Chapman, J.D., *See* Wiebe, L.I., 15:963

Chapman, R.L., Status of spent-fuel transportation system development, 15:131 (J;US)

Chappell, J.R., *See* Sommers, G.L., 15:234

Charity, R.J., *See* Pochodzalla, J., 15:1801

Chatman, M.L., Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)

Chemin, J.F., *See* Stolterfoht, N., 15:1785

Chen, C.C., Maanshan small-LOCA analysis, 15:537 (J;US)

Chen, Chiping, Self-field-induced chaotic electron motion in free electron lasers, 15:1036 (R;US)
Chen, G.S., Numerical solution of the two-dimensional space-time diffusion equations, 15:443 (J;US)
Chen, J.G., *See* Shi, D., 15:862
Chen, J.R., The uses of synchrotron radiation sources for elemental and chemical microanalysis, 15:1212 (R;US)
Chen, M., Measurements of neutron emission induced by muons stopped in metal deuteride targets, 15:1883 (R;US)
Chen, S.Y., Effectiveness of cleanup criteria relative to an accidental nuclear release, 15:527 (J;US)
Chen, Y., [Prospect for wavelength tunable lasers based on vacancy defects in alkaline-earth oxides]: Foreign trip report, September 18, 1989–September 30, 1989, 15:1034 (R;US)
Chen, Y.C., *See* Oh, J.E., 15:885, 15:886
Chen, Zhu-zhou, Major issues on establishing an emergency plan in nuclear facilities, 15:488 (TJ;US)
Cheng, C.C., Correlation of interface structure with adhesive strength of ion-plated TiN hard coatings, 15:820 (R;US)
See Erdemir, A., 15:819
Cheng, H., *See* Trampetic, J., 15:1758
Cheng, H.S., Reactivity transients during a blowdown in a MSIV closure ATWS, 15:514 (J;US)
Cheng. E.T., *See* Herring, J.S., 15:1935
Cheong, S., *See* Hundley, M.F., 15:861
See Kaplan, S.G., 15:858
Cheung, A.C., *See* Takeuchi, K., 15:455
Chevacharoenkul, S., Dislocation mechanisms, diffusional processes and creep behavior in NbC_{chl}, 15:839 (J;US)
Chia, Y.P., *See* Yu, C., 15:188
Chian, A.C.-L., Generation mechanism of type III radio emission in the solar wind, 15:1561 (RA;BR)
See Serbeto, A. de P.B., 15:1686
Chiang, K.T., *See* Perkins, R.A., 15:752
Chiang, S.C., *See* Chen, C.C., 15:537
Chiang, W.H., *See* Ryu, D., 15:1572
Chiarizia, R., Application of supported liquid membranes for removal of uranium from groundwater, 15:1345 (R;US)
Chidambariah, Venkatesh, Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final, 15:732 (R;US)
Chien, S.H., *See* Flanagan, G.F., 15:484
Chigira, Masahiro, Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)
Childress, J.R., *See* Briant, V.S., 15:408
See Fiedler, P.B., 15:345
Childs, K.F., *See* Christensen, A.B., 15:124
Chiles, M.M., Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 15:1160 (R;US)
Ching, W.Y., *See* Zhong, X., 15:810
Chinn, C.R., Quasielastic (e,e') sum rule saturation, 15:1820 (J;US)
Chirila, J.V., Statistical prediction of the ship's propulsive power, 15:694 (R;DE;In German)
Chivukula, R.S., Higgs decay into Goldstone Bosons, 15:1760 (J;US)
Cho, M.H., *See* Hershkowitz, N., 15:1217
Chopra, O.K., *See* Chung, H.M., 15:763
Chou, H., *See* Wu, M.K., 15:879
Chou, W., Emittance growth in a storage ring due to ground motion, 15:1143 (R;US)
Impedance calculations for 2-D and 3-D structures and the impedance budget of 7-GeV APS [Advanced Photon Source] storage ring, 15:1142 (R;US)
Chou, Y., Avoiding steam-bubble-collapse-induced water hammers in piping systems, 15:336 (R;US)
Chrispeels, M.J., *See* Shannon, L.M., 15:1367
Christensen, A.B., Water filtration problems at the Idaho Chemical Processing Plant Fuel Storage Area, 15:124 (J;US)
Christensen, R.N., Doubly-fluted tubes and enhanced tubes in confined crossflow. Annual report, August 1987-July 1988, 15:1057 (R;US)
Christon, M., *See* Burns, P.J., 15:1988
Christopher, T.A., Operating plant scorecard: A statistical analysis of plant outage performance, 15:348 (J;US)
Chrzanowski, P.L., The cost effectiveness of modernized US strategic forces, 15:1230 (R;US)
Chu, V., *See* Shen, D.S., 15:902
Chu, W.T., *See* Renner, T.R., 15:1208
Chu, Y.Y., *See* Beavis, D., 15:1203
Chughtai, M.Y., Development and testing of a staged-mixing burner with injection of additives for the simultaneous reduction of SO_2 and NO_x emissions in coal and oil firing systems, 15:1085 (R;DE;In German)
Chumbalov, A.A., Photoproduction of pions off nucleons and nuclei, 15:1735 (R;SU)
Theoretical aspects of pion photoproduction off light nuclei, 15:1736 (R;SU)
Chumming, J.B., *See* Beavis, D., 15:1203
Chun, S.Y., *See* Wilson, J.W., 15:1740
Chung, H.M., Accelerated aging embrittlement of cast duplex stainless steel: Activation energy for extrapolation, 15:763 (R;US)
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)
Chung, Sun-Kyo, A knowledge-based system for control of xenon-induced spatial power oscillations during load-follow operations, 15:468 (J;US)
Chung, T.J., SRB combustion dynamics analysis computer program (CDA-2). Final report, 15:973 (R;US)
Chupp, E.L., *See* Share, G.H., 15:1149
Chyba, C.F., *See* Khare, B.N., 15:1609
Ciampo, L.J. del., *See* Scalise Junior, E., 15:1558
Cieslak, M.J., *See* Scully, J.R., 15:799
Cigarini, M., *See* Mori, T., 15:492
Cinar, A., *See* Adomaitis, R.A., 15:1985
Cirillo, J., *See* Loer, S., 15:1130
Cirillo, R.R., Hazardous waste research and development in the Pacific Basin, 15:1297 (R;US)
Cisneros, M., *See* Meijaer, A., 15:155
Ciszek, T.F., Silicon material quality and throughput: The high and the low, the fast and the slow, 15:256 (BA;US)
See Pang, S.K., 15:904
Clark, B.C., Martian regolith geochemistry and sampling techniques, 15:1573 (RA;US)
Clark, R.E.H., Electron-impact cross sections and coherence parameters for the $6s^2\ ^1S$–$6s6p\ ^1P$ transition in neutral barium, 15:1709 (J;US)
Clarke, J., Principles and applications of SQUIDs, 15:1012 (J;US)
Clarke, J.F., Status of magnetic fusion, 15:1912 (J;US)
Clarkson, I., *See* Wilford, C.F., 15:770
Clausi, J.V., *See* Meyer, A.P., 15:669
Claussen, R.L., *See* Allen, R.E., 15:380
Clemans, W.H., Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion, 15:114 (R;US)
Clements, J., *See* Greathouse, D., 15:737
Clements, W.E., Experimental design of the 1984 ASCOT field study*, 15:1281 (J;US)
Mean structure of the nocturnal drainage flow in a deep valley*, 15:1242 (J;US)
Clemesha, B.R., Upper atmospheric research in Brazil, 15:1621 (RA;BR)
See Batista, P.P., 15:1647
See Gobbi, D., 15:1655
Cleveland, J., Loss-of-coolant accident experiment at the AVR gas-cooled reactor, 15:485 (R;US)
Clifford, D., Evaluating various adsorbents and membranes for removing radium from ground water, 15:1346 (R;US)
Clifft, B.E., *See* Den Hartog, P.K., 15:1090
Close, F.E., Testing QCD with milli-TeV electrons, 15:1742 (J;NL)
Cloth, P., *See* Filges, D., 15:1166
Clough, R.L., *See* Gillen, K.T., 15:896
Clout, P.N., *See* Howell, J.A., 15:1095
Coates, J.F., Why issues emerge: Final report, 15:592 (R;US)
Cochran, B., *See* Hild, R.D., 15:456
Coensgen, F.H., *See* Futch, A.H., 15:1971

Coffey, H.E., Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1989, and miscellaneous, 15:1600 (R;US)
Cohen, A., *See* Chivukula, R.S., 15:1760
Cohen, E.G.D., *See* Kong, X.P., 15:1863
Cohen, J., $0^+, T=0(p,p')0^-, T=1$ pion like excitations and nuclear response in the spin-isospin channel, 15:1825 (J;US)
Cohen, M., *See* Booser, E.R., 15:303
Cohen, M.L., *See* Wang, X.W., 15:867
Cohen, S., The development of a standard format for accelerator data analysis, 15:1127 (R;US)
Colas, P., A new νanti ν + multiphoton generator derived from KORALZ, 15:1739 (R;DE)
Colchin, R.J., *See* Neilson, G.H., 15:1889
Coleman, G.H., *See* Hamrick, T.P., 15:477
Coleman, R.D., Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)
Coles, E., *See* Raghaven, R., 15:1321
Collins, C., Investigation of high-temperature materials for uranium-fluoride-based gas core reactor systems, 15:437 (J;US)
Collins, E.D., *See* Caudill, H.H., 15:917
Collins, W.D., *See* Long, E.R. Jr., 15:882
Collman, J.P., *See* Little, W.A., 15:1875
Colombo, L.L., *See* Rubio, M.C., 15:1398
Coluccia, G.A., *See* Rivera, E.S., 15:1399
Colwell, J.A., *See* Wright, I.G., 15:836
Combs, R.T., Virginia Power's study of a Shell-based GCC [gasification combined-cycle] power plant: Final report, 15:9 (R;US)
Combs, S.K., *See* Gouge, M.J., 15:1919
Comparat, V., Gas detectors for heavy ions, 15:1164 (R;FR;In French)
Conde, J.P., *See* Shen, D.S., 15:902
Conklin, J.C., Thermophoretic transport of particles that act as volumetric heat sources in natural convection flow, 15:338 (R;US)
Conlin, K.E., *See* Clemans, W.H., 15:114
Conn, R.W., *See* Hirooka, Y., 15:910
Connolly, J.S., *See* Seibert, M., 15:1378
Conrad, F.J., *See* Kenna, B.T., 15:1222
Constanta-Fanourakis, P., Exabyte helical scan devices at Fermilab, 15:1136 (J;US)
See Petravick, D., 15:1135
Conti, F., *See* Zabot, S., 15:281
Conway, L.E., Passive containment cooling for an advanced PWR, 15:373 (J;US)
Cook, A., *See* Deppe, J., 15:1209
Cook, B.C., *See* Benesh, C.J., 15:1819
Cook, D.H., *See* Flanagan, G.F., 15:484
Cook, E., Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
Cook, J., *See* Nicholls, G., 15:1110
Cooke, D.J., Studies of the cosmic ray penumbra. Final report, 9 September 1980-30 September 1985, 15:1548 (R;US)
Cooke, D.W., *See* Jahan, M.S., 15:842
Coop, K.L., Neutron dieaway methods for criticality safety measurements of fissile waste, 15:153 (R;US)
Cooper, A.S., *See* Bazhenov, A.V., 15:850
Coose, J.P., Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988, 15:101 (R;US)
Copeland, R.A., *See* Rensberger, K.J., 15:978
Coppens, P., SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
Corbett, R.A., A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)
Corey, C.W., *See* Burnham, A.K., 15:631
Cornelius, D.E., *See* Burton, S.R.M., 15:933
Corrales, R., *See* Grigsby, C.O., 15:294
Corsberg, D., A nuclear reactor alarm display system utilizing AI techniques for alarm filtering, 15:459 (BA;US)
Costa, A.M. da, Low ionosphere electron density profiles for the Antartic and south Atlantic geomagnetic anomaly regions associated to PCA events, 15:1651 (RA;BR)
See Piazza, L.R., 15:1666
Cottrell, W.D., Results of the radiological survey at 7 Hancock Street, Lodi, New Jersey (LJ027), 15:1308 (R;US)
Results of the radiological survey at 5 Hancock Street, Lodi, New Jersey (LJ029), 15:1309 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
See Fields, D.E., 15:205
See Foley, R.D., 15:1313, 15:1314
Coulombe, B.D., *See* Ferro, P.D., 15:305
Counce, D.A., *See* Grigsby, C.O., 15:294
Courant, E.D., [High energy accelerators]: Foreign trip report, August 19, 1989–August 31, 1989, 15:1092 (R;US)
Cousins, T., Anthropomorphic phantom radiation dosimetry at 400 m from a fission source, 15:1847 (J;US)
Coutts, T.J., *See* Yahia, A.H., 15:267
Covey, C., Global environmental effects of impact-generated aerosols: Results from a general circulation model, 15:1238 (RA;US)
Cowley, C.R., *See* Bidelman, W.P., 15:1605
Cowley, S.C., Some considerations of "cold fusion" including the calculation of fusion rates in molecules of hydrogen isotopes, 15:1885 (R;US)
Cox, A.N., Oscillations of solar models with internal element diffusion, 15:1613 (J;US)
Cox, L.E., *See* Farr, J.D., 15:1693
Cox, L.T., Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989, 15:1887 (R;US)
Cozzolino, J., *See* Prodell, A.G., 15:1118
Crabtree, G.W., *See* Dabrowski, B., 15:823
See Welp, U., 15:864
Craddick, W.G., *See* Flanagan, G.F., 15:484
Craig, P.M., *See* Yager, R.E., 15:164
Craig, S.L., *See* Den Hartog, P.K., 15:1090
Cramer, S.N., Analytic solution of a five-direction radiation transport model, 15:1836 (J;US)
Cramond, W.R., *See* Camp, A.L., 15:520
Crane, T.W., *See* Rinard, P.M., 15:151
Crocket, J.H., *See* Huffman, A.R., 15:1490
Crooks, R.S., *See* Zwan, A.D., 15:755
Cropper, M.B., *See* Kamperschroer, J.H., 15:1970
Crosbie, E.A., The positron accumulator ring for the APS, 15:1145 (R;US)
See Kramer, S.L., 15:1109
Crosley, D.R., *See* Rensberger, K.J., 15:978
Crow, J.E., *See* Kebede, A., 15:851
Crowe, R.D., Computer-controlled flux monitoring using high-density, self-powered incore detectors, 15:458 (R;US)
See Toffer, H., 15:528
Crume, E.C., *See* Neilson, G.H., 15:1889
Crumpler, E.P., Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Crutcher, J.W., *See* Foley, R.D., 15:1311, 15:1312, 15:1315, 15:1316
Crutzen, P.J., *See* Thompson, S.L., 15:1530
Csanak, G., *See* Clark, R.E.H., 15:1709
Cucinell, S.J., *See* Feng, X., 15:196
Cucinotta, F.A., *See* Wilson, J.W., 15:1740
Cudell, J.R., How well do we know the Kobayashi-Maskawa matrix?, 15:1753 (J;US)
Cunha, O.C. da, *See* Santos, P.R.G., 15:940

Cupitt, J., Brief walk through KAOS (Kent Applicative Operating System), 15:1992 (R;GB)
Curran, J.F., *See* Mengers, T.F., 15:1406
Curreri, P.A., *See* Wu, M.K., 15:879
Czajkowski, G., *See* Johnson, R.W., 15:3

D

Dabrowski, B., $La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)
See Wagener, T.J., 15:854
Dabrowski, B.D., *See* Pei, S.Y., 15:821
Dagenhart, W.K., *See* Muller, R.C., 15:991
Dahlke, H.J., *See* Uldrich, E.D., 15:1320
Daish, S.R., *See* Beahm, E.C., 15:356
Dale, D.S., *See* Alarcon, R., 15:1792
Dale, V.H., Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations, 15:1257 (R;US)
[Global natural resource monitoring and assessment]: Foreign trip report, September 23–October 7, 1989, 15:1301 (R;US)
Dalesio, L.R., *See* Howell, J.A., 15:1095
Daling, P.M., *See* Schneider, K.J., 15:204
Dalle Donne, M., *See* Mori, T., 15:492
Dallman, R.J., *See* Chambers, R., 15:522
Dally, W.J., J-machine: System support for actors. Memorandum report, 15:1978 (R;US)
Damm, C.C., *See* Futch, A.H., 15:1971
Daniel, S.L. Jr., Power system planning and engineering–research needs and priorities: Proceedings, 15:649 (R;US)
Danofsky, R.A., The midwest workshop on preparing nuclear engineering professionals, 15:405 (J;US)
See Chung, Sun-Kyo, 15:468
Danyluk, S., *See* Balachandran, U., 15:822
Das, D.K., *See* Zarling, J.P., 15:1414, 15:1415
Das, S., *See* Hadder, G.R., 15:63, 15:78
Datz, S., *See* Kephart, J.O., 15:1862
Davenport, A.J., [Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989, 15:769 (R;US)
Davenport, S.A., *See* Wdowiak, T.J., 15:1535
Davidson, A.W., Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)
Davidson, H., *See* Nellis, W.J., 15:800
Davidson, R.C., *See* Chen, Chiping, 15:1036
Davis, E.C., *See* Spalding, B.P., 15:165
Davis, F.G., The demonstration of monolithic and composite ceramics in aircraft gas turbine combustors, 15:818 (RA;US)
Davis, J.B., *See* Dearborn, L.L., 15:1296
Davis, J.C., *See* Thomas, M.M., 15:1215
Davis, J.W., [International Energy Agency workshop on fusion materials database]: Foreign trip report, June 5, 1988–June 11, 1988, 15:1964 (R;US)
Davis, M.V., Lead management at the INEL [Idaho National Engineering Laboratory], 15:149 (R;US)
Davis, R.F., *See* Chevacharoenkul, S., 15:839
Davis, R.M., *See* Hadder, G.R., 15:63, 15:78
Davis, S.A., [Welding under extreme conditions]: Foreign trip report, August 29, 1989–September 14, 1989, 15:791 (R;US)
Davis, S.C., Transportation energy data book: Edition 10, 15:696 (R;US)
Davis, T., *See* Hall, B.E., 15:531
Davison, W.W., Metal oxide films from carboxylate precursors, 15:817 (R;US)
Davoine, F., *See* Durand, J.L., 15:433
Dawson, L.R., *See* Kurtz, S.R., 15:255
See Lott, J.A., 15:1077
Dawson, S., *See* Shen, D.H., 15:567
De Groot, A.J., *See* Hoover, W.G., 15:1067
De La franier, C., *See* Harkness, A.C., 15:570
De Sangro, R., *See* Ford, W.T., 15:1727
de Vore, L., *See* Burnham, A.K., 15:631
Dean, D.J., Velocity dependence of prompt, high-energy nucleon emission, 15:1822 (J;US)
Dean, W.E., *See* Zachos, J.C., 15:1539
Dearborn, L.L., Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)
Deb, S.K., *See* Tsuo, Y.S., 15:900
Debbe, R., *See* Chen, M., 15:1883
Debsikdar, J.C., Superconducting film fabrication by the sol-gel process, 15:825 (R;US)
Debus, R.J., Directed mutagenesis indicates that the donor to P^+_{680} in photosystem II is tyrosine-161 of the D1 polypeptide, 15:1384 (J;US)
Decker, C., *See* Coates, J.F., 15:592
Decker, D.L., *See* Dabrowski, B., 15:823
Decker, J.F., Large-scale problems and supercomputing in the Department of Energy, 15:2005 (J;US)
Deeg, H.J., *See* Spielberg, H., 15:1417
DeFord, J.F., *See* Avery, R.K., 15:1129
Degering, D., Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
See Kim, J.H., 15:1187
Dejonge, R., *See* Smit, J., 15:1527
Dejonghe, L.C., *See* Visco, S.J., 15:553
del Aguila, F., Possible method in some extensions of the standard model to produce and detect Higgs bosons at hadron colliders, 15:1745 (J;US)
Del Debbio, J.A., Transport properties of radionuclides and hazardous chemical species in soils at the Idaho Chemical Processing Plant, 15:175 (R;US)
Del Grande, N.K., L-shell photoabsorption spectroscopy for solid metals: Ti, V, Cr, Fe, Ni, Cu, 15:1698 (R;US)
Delano, J.W., Glass: a source of data leading to constraints on the volcanic, impact, and atmospheric histories of Mars, 15:1574 (RA;US)
DeLaPaz, R.L., *See* Lo, E.H., 15:1435
Delayen, J.R., Temperature, frequency, and rf field dependence of the surface resistance of polycrystalline $YBa_2Cu_3O_{7-x}$, 15:859 (J;US)
Delene, J.G., Economic potential for future water reactors, 15:350 (J;US)
Deligiannis, F., *See* Shen, D.H., 15:567
See Subbarao, S., 15:563
DeMiranda, J.M., *See* Constanta-Fanourakis, P., 15:1136
Demos, E.K., Energy and waste management, 15:593 (RA;US)
Energy and waste management, 15:602 (RA;US)
Den Hartog, P.K., Operational experience of the ATLAS accelerator, 15:1090 (R;US)
Dennis, B., *See* Grigsby, C.O., 15:294
Dennis, R.A., *See* Meyer, C.T., 15:35
Dennison, J.R., *See* Larese, J.Z., 15:913
Deppe, J., ACP/R3000 processors in data acquisition systems, 15:1209 (J;US)
Desaussure, G., *See* Goldstein, M., 15:1990
Descroix, J.P., *See* Planchat, J.P., 15:574
Desjarlais, M.P., The effect of charge exchange processes on ion diode impedance, 15:1708 (J;US)
Dessau, D.S., *See* Lindberg, P.A.P., 15:847, 15:857
See Shen, Z.X., 15:1873
See Wells, B.O., 15:863
Destler, W.W., Experimental studies of the laser-controlled collective ion accelerator, 15:1104 (J;US)
Destot, M., *See* Durand, J.L., 15:433
Determan, D., *See* Hanlon, D., 15:724
Dever, D.J., *See* Tilbrook, R.W., 15:517
Dewit, C.B., *See* Tredous, M., 15:1531
DeWitt, D., *See* Schneider, D., 15:1711
Dhar, Y.J., *See* Appleby, A.J., 15:556
Dhondt, S., Extended Cretaceous-Tertiary (K/T) stable isotope record. Implications for paleoclimate and the nature of the K/T boundary event, 15:1478 (RA;US)
Di Stefano, S., *See* Ratnakumar, B.V., 15:572
Diamond, D.J., *See* Cheng, H.S., 15:514
Dias, M.J.P., *See* Iozzi, F.B., 15:927
Dick, J.E., Event sequence of a severe accident in a single-unit CANDU reactor, 15:534 (J;US)

Dickel, J.R., Radio emission from young supernova remnants - Effects of an inhomogeneous circumstellar medium, 15:1611 (J;US)
Dickens, J.K., NE110 scintillator response to 10-100 MeV carbon ions, 15:1206 (J;NL)
Dickerson, M.H., Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)
Dickinson, B.W., System theoretic models for high-density VLSI (very large scale integration) structures. Final technical report, 15:1979 (R;US)
Dickson, L.W., *See* Mulpuru, S.R., 15:519
DiCola, F.E., Optimizing preventive maintenance, 15:418 (J;US)
Dienes, A., *See* Mortazavi, M.A., 15:912
Dietz, D., *See* Raghaven, R., 15:1321
Difilippo, F.C., Theoretical analysis of reactivity measurement with the ^{252}CF source ratio method, 15:423 (R;US)
Dilorio, M.S., Wide-band superconductive Chirp filters, 15:982 (R;US)
Dijalli, S., *See* Mortazavi, M.A., 15:912
Ding, Jian, Thermally stable metal/GaAs contacts, 15:878 (R;US)
Dingman, S.E., MELCOR analyses of drywell flammability, 15:340 (R;US)
Dingus, M.L., Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989, 15:984 (R;US)
Dircks, K., *See* Watkins, D., 15:667
Distefano, S., Advanced rechargeable sodium batteries with novel cathodes, 15:554 (RA;US)
Ditta, J., *See* Boniface, J., 15:776
Dixon, T.M., *See* Ahrenkiel, R.K., 15:907
Djerassi, H., *See* Cadwallader, L.C., 15:1936
Dobosy, R.J., Mass and momentum balance in the Brush Creek drainage flow determined from single-profile data, 15:1240 (J;US)
See Addis, R.P., 15:1286
Dodds, H.L. Jr., *See* Roberts, M.W., 15:1008
Dodds, N.E., *See* Tracy, D.B., 15:113
Dodson, G., *See* Miller, L., 15:559
Doehne, E.F., *See* Margolis, S.V., 15:1500
Doering, J., *See* Kleinwaechter, P., 15:1178
Doherty, J.P., Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries, 15:199 (P;US)
Dolfini, S., *See* Papanicolas, C.N., 15:1205
Dols, W.S., Ventilation and air-quality investigation of the US Geological Survey building, 15:692 (R;US)
Dombeck, T.W., *See* Freedman, M.S., 15:1779
Dominey, L.A., Physicochemical factors influencing LiAsF6 reactivity, 15:568 (BA;US)
Domingo, N., *See* Hadder, G.R., 15:63, 15:78
Dominguez-Rodriguez, *See* Heuer, A.H., 15:840
Domun, M.K., Accelerated life tests on 11 kV and 33 kV MIND paper cables in the laboratory, 15:326 (R;GB)
Condition monitoring of 132 kv bushings, 15:327 (R;GB)
Prediction of remaining lives of 132 kV grid transformers, 15:328 (R;GB)
Dongarra, J., *See* Brewer, O., 15:1986
Doniat, D., *See* Bugnet, B., 15:582
Donley, S., Short circuit detection and active/passive transitions in nickel hydrogen cells, 15:578 (BA;US)
Doran, J.C., Measurements of turbulent heat and momentum fluxes in a mountain valley, 15:1246 (J;US)
Dorn, R.V. III, PBF/BNCT program for cancer treatment: Volume 3, No. 7, Bulletin, 15:1430 (R;US)
PBF/BNCT [Power Burst Facility/Boron Neutron Capture Therapy] Program for cancer treatment: Bulletin, 15:1428 (R;US)
PBF/BNCT [power burst facility/boron neutron capture therapy] program for cancer treatment: Volume 3, No. 6, 15:1429 (R;US)
Dorning, J.J., *See* Holloway, J.P., 15:1910
See Kim, S.T., 15:1837
See Rizwan-uddin, 15:448
Dorries, T., FEREAD: Front end readout software for the Fermilab PAN-DA data acquisition system, 15:1138 (J;US)
See Petravick, D., 15:1135
See Pordes, R., 15:1133
Doster, J.M., Applications of parallel computer architectures to the real-time simulation of nuclear power systems, 15:358 (J;US)
See Sills, E.D., 15:366
Douglas, A.S., *See* Sharpe, W.N., 15:753
Drago, V.J., *See* Hoess, J.A., 15:132
Drake, C.L., *See* Officer, C.B., 15:1508
Drake, R.P., X-ray emission caused by Raman scattering in long-scale-length plasmas, 15:1916 (J;US)
Drapchinsky, L.V., *See* Herbach, C.M., 15:1191, 15:1778
Dreist, A., The injection system of the stretcher ring ELSA, 15:1108 (R;DE;In German)
Drexler, G., On the influence of the exposure model on organ doses, 15:1841 (J;US)
Drigert, M.W., *See* Ahmad, I., 15:1799
Drozdz, S., On a validity of adiabatic approach to the tunneling phenomena, 15:1879 (R;DE)
Drummond, S.E., *See* Palmer, D.A., 15:948
Dryer, M., MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988, 15:1602 (R;US)
du Mont, S.P., *See* Youngblood, E.L., 15:159
du Plessis, L.A., Analysis of samples from the Purex vessel vent silver reactor, 15:134 (R;US)
Some observations concerning the chemistry of the Purex vessel vent silver reactor, 15:135 (R;US)
Duarte, C.L., Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)
Duarte, D.S., Development and testing program update for remote cell production of Pu 239, 15:1000 (R;US)
Dubner, Diana, *See* Fernandez de Giorgi, Cristina, 15:1433
DuBois, R.D., *See* Schneider, D., 15:1711
Duda, J.R., Type curves for predicting production performance from horizontal wells in low-permeability gas reservoirs, 15:90 (BA;US)
Dudek, L.E., *See* Kamperschroer, J.H., 15:1970
Dudenhoefer, J.E., *See* Ibrahim, M.B., 15:1054
See Miller, E.L., 15:742
Duek, E., *See* Beavis, D., 15:1203
Dugan, P.R., Approaches to cleaning and conversion of coal through bioprocessing, 15:8 (R;US)
Duhan, S., *See* Torre, A. de la, 15:1900
Duhan, S.N., *See* Alexander, P.M., 15:1677
Duhau, S.N., *See* Louro, A.A., 15:1657
Dulick, M., *See* Nguyen, D.C., 15:1045
Duncan, L.M., *See* Noble, S.T., 15:1689
Dunlap, J.L., *See* Neilson, G.H., 15:1889
Dunlavy, D.J., *See* Ahrenkiel, R.K., 15:905, 15:906, 15:907
Dunn, J.E., *See* Linak, W.P., 15:736
Durand, J.L., Collaboration in nuclear engineering education between France and the United States: Research opportunities for US students in France, 15:433 (J;US)
See Peddicord, K.L., 15:434
Durand, L., Semihard QCD and high-energy *pp* and $\bar{p}p$ scattering, 15:1750 (J;US)
Durant, W.S., *See* Perkins, W.C., 15:116
Durell, J.L., *See* Ahmad, I., 15:1799
Durst, F., *See* Pereira, J.C.F., 15:1050
Dutkiewicz, A.G., *See* Penny, R.K., 15:992
Dutra, S.L.G., Periodicities in the atmospheric electric field measured at the South Atlantic geomagnetic Anomaly, 15:1680 (RA;BR)
Dyer, G.R., *See* Neilson, G.H., 15:1889
Dylla, H.F., *See* Kamperschroer, J.H., 15:1970
Dyrkacz, G.R., *See* Anderson, K.B., 15:18

E

Eagar, C., *See* Irving, P.M., 15:1256
Eastman, T.E., Boundary-layer dynamics in the description of magnetospheric substorms, 15:1541 (R;US)
See Tsurutani, B.T., 15:1639
Eberhardt, L.E., Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988, 15:166 (R;US)
Ebert, P.J., Non-intrusive verification: Revision 1, 15:1234 (R;US)
Ebert, W.L., The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater, 15:138 (R;US)

Ebey, P.S., *See* Chakoumakos, B.C., 15:844
Eck, T., Free market economics: Graphs and figures, 15:644 (RA;US)
Eckerl, H., *See* Drexler, G., 15:1841
Eckert, M.J., *See* Lee, R.R., 15:407
Eckman, R.M., *See* Dobosy, R.J., 15:1240
Eckstein, P., Fast trigger for neutron time-of-flight measurement, 15:1195 (RA;DD)
Edel, M., *See* Deppe, J., 15:1209
Edeskuty, F.J., *See* Kirtley, J.L., 15:1009
Edgar, E.C., *See* Owsenek, L.W., 15:367
Edwards, B., *See* Fox, J., 15:1255
Eftekhari, A., *See* Singh, J.J., 15:222
Egbert, S.D., Anthropomorphic phantoms, 15:1842 (J;US)
Egeberg, P.K., *See* Wise, S.W., 15:1537
Eggleston, H.S., Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986, 15:1263 (R;GB)
Eguchi, Masayoshi, Survey of adaptive control theory and its applications, 15:322 (R;JP;In Japanese)
Eichhorn, K., *See* Langrock, E.J., 15:970
Eikhoff, J.V.D., *See* Bruhns, O.T., 15:771
Eilek, J.A., *See* Dickel, J.R., 15:1611
Einziger, R.E., *See* Mings, W.J., 15:130
See Thomas, L.E., 15:375
Eisele, J.A., *See* Share, G.H., 15:1149
Eisenberg, M., *See* Reisner, D., 15:580
Eisman, G.A., The application of Dow Chemical's perfluorinated membranes in proton-exchange membrane fuel cells, 15:660 (RA;US)
Ekberg, J.O., $3p^6 3d^6$–$3p^5 3d^9$ Transitions in ironlike Sb, 15:1042 (J;US)
See Brown, C.M., 15:1043
See Feldman, U., 15:1044
El-Sayed, M.A., *See* Jang, Dujeon, 15:1383
Elbl, M., *See* Bartok, W., 15:312
Elisman, Y.L., [Production of coils for magnets of European colliders]: Foreign trip report, September 25, 1989–September 27, 1989, 15:1119 (R;US)
Elliott, C.J., Analytical treatment of electron trajectory straightener issues in free-electron lasers, 15:1030 (R;US)
Elliott, D.C., Low-temperature conversion of high-moisture biomass: Continuous reactor system results, 15:254 (R;US)
Elliott, S.M., *See* McIntyre, P.M., 15:1114
Elliott, W.P., Statistical treatment of CO_2 data records. Technical memo, 15:1266 (R;US)
Ellis, E.R., *See* Jaeger, C.A., 15:364
Ellis, K.J., Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)
Ellis, S.D., *See* Sarcevic, I., 15:1771
Ellis, W.P., *See* Shen, Z.X., 15:1873
Elston, W.E., Proterozoic Bushveld-Vredefort catastrophe: Possible causes and consequences, 15:1479 (RA;US)
Embrey, J., Investigation of alternate electrolytes for thermal batteries, 15:576 (BA;US)
Emery, K.A., *See* Hart, R.E. Jr., 15:268
Emin, D., *See* Tallant, D.R., 15:866
Emling, H., *See* Ahmad, I., 15:1799
Enayatullah, M., *See* Srinivasan, S., 15:659
Endoh, Y., *See* Graf, H.A., 15:808
See Thurston, T.R., 15:856
See Yamada, K., 15:855
Enghardt, W., Evaluation of $\gamma\gamma$-coincidence matrices, 15:1200 (RA;DD)
Implementation of an universal stopping power code to the ES 1055 computer, 15:1833 (RA;DD)
England, A.C., *See* Neilson, G.H., 15:1889
England, T.R., ENDF/B-VI six-group delayed neutron data, 15:1798 (R;US)
ENDF/VI six-group delayed neutron data, 15:1797 (R;US)
See Young, P.G., 15:1776
Englin, J., *See* Lee, A.D., 15:654
Enick, R.M., The incorporation of the effects of CO_2 solubility in brine into a compositional simulator, 15:57 (B;US)
Eno, F., Tracking harmonic notch filter, 15:333 (P;US)
Enoeda, M., Separation of helium and hydrogen isotopes by ISS [Isotope Separation System] at the TSTA, 15:1950 (R;US)
See Bartlit, J.R., 15:1952
See Ide, T., 15:1945
Entringer, A.G., *See* Shinar, R., 15:951
Epp, D., *See* Watkins, D., 15:667
Epstein, A.J., *See* Chakraborty, A., 15:865
Eramzhyan, R.A., *See* Chumbalov, A.A., 15:1735, 15:1736
Erdemir, A., Nucleation and growth mechanisms in ion-plated TiN films on steel substrates, 15:819 (R;US)
See Cheng, C.C., 15:820
Erdman, C.A., *See* Peddicord, K.L., 15:434
Erickson, M.D., *See* Boparai, A., 15:24
Erkkila, B.H., A safeguards program to implement DOE requirements, 15:214 (R;US)
Ernst, B., ANI [American Nuclear Insurers] support and research facility nuclear liability insurance inspection program, 15:212 (J;US)
Erskine, D.J., *See* Mitchell, A.C., 15:1604
Escalante, E., *See* Interrante, C., 15:160
Esherick, P., Polarization feedback laser stabilization, 15:1047 (P;US)
Estabrook, K., *See* Drake, R.P., 15:1916
Etchison, D., Achieving an energy-secure economy: Options for Illinois and the Midwest, 15:643 (RA;US)
Etemadi, B., *See* Jones, H.W., 15:1691
Eurell, T.E., Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)
Evans, J., Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)
Evans, J.C., *See* Sherwood, D.R., 15:1341
Evans, J.W., Cooperative adsorption-desorption models with random steady states, 15:953 (J;US)
Evans, K. Jr., *See* Peng, Y.K.M., 15:1888
Evenson, K.M., *See* Schneider, M., 15:1035
Eversheim, P.D., CANU workshop on polarization physics at COSY, 15:1125 (R;DE;In German)
Ezquer, R.G., TEC studies in Argentina, 15:1652 (RA;BR)

F

Faas, S., *See* Castro, M., 15:287
Faber, J. Jr., *See* Kupperman, D.S., 15:849
Fabrikant, J.I., The carcinogenic risks of low-LET and high-LET ionizing radiations, 15:1436 (R;US)
See Lo, E.H., 15:1435
Fagundes, P.R., Simultaneous observations of the OI 5577NM, NaD, O_2 (0,1) and OH (9,4) nightglow emissions at 23^0S, 15:1653 (RA;BR)
Fai, G., *See* Yuan, H.J., 15:1824
Fajen, J., *See* Fan, S., 15:1271, 15:1272
Fan, S., Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
Fan, W.C., *See* Badruzzaman, A., 15:473
Fanning, W.L., *See* Gundlach, E.R., 15:1326
Farland, W.H., Workshop report on EPA (Environmental Protection Agency) guidelines for carcinogen risk assessment. Held in Virginia Beach, Virginia on January 11-13, 1989, 15:1462 (R;US)
Farmer, T.E., Damage tolerance concepts for advanced materials and engines, 15:1082 (RA;US)
Farr, J.D., Core-level binding energy shifts of the light actinide tetrafluorides and dioxides, 15:1693 (R;US)
Fatemi, N., *See* Bailey, S.G., 15:251
Fatyga, M., *See* Skulski, W., 15:1821
Faulkner, G.E., *See* Nguyen, D.C., 15:1045
Faust, C., *See* Levine, S.H., 15:479
Faut, O.D., *See* Zehe, M.J., 15:943
Fearing, H.W., KAON physics, 15:1097 (R;CA)

Fedro, A.J., Nearest-neighbor repulsion in electron-doped high-temperature cuprate superconductors, 15:1876 (J;US)
Fegley, B. Jr., *See* Cameron, A.G. W., 15:1607
See Prinn, R.G., 15:1513
Fejer, B.G., Low latitude electric fields, 15:1623 (RA;BR)
Feld, S., *See* Sciacca, F.W., 15:421
Feldman, C., Standard format and content for decommissioning plans for nuclear reactors, 15:501 (R;US)
Feldman, U., Wavelengths and energy levels for Ge xxiv, Ge xxv, and Ge xxvi observed in plasmas produced by line-focus laser irradiation, 15:1044 (J;US)
See Brown, C.M., 15:1043
See Ekberg, J.O., 15:1042
Feldmayer, C.F., Force structure implications of START. Study project, 15:749 (R;US)
Fellows, M.E., United Kingdom Minerals Yearbook, 1988. Statistical data to 1987, 15:621 (R;GB)
Felton, W.J., *See* Wen, T., 15:1322
Feng, P.Y., *See* Balasubramanian, K., 15:1715
Feng, X., Correlation between composition effects on glass durability and the structural role of the constituent oxides, 15:196 (J;US)
Fenske, G.R., *See* Cheng, C.C., 15:820
Fernandez de Giorgi, Cri, Methodology for the evaluation of decontaminant drugs at in vitro systems., 15:1433 (RA;AR;In Spanish)
Fernandez, W.J., *See* Blais, N.C., 15:1221
Fernandez-Baca, J.A., Magnetic excitations in thulium metal, 15:1849 (R;US)
Ferrada, J.J., Application of neural networks for fault diagnosis in plant production, 15:1983 (R;US)
Ferro, P.D., Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
Fiedler, J., *See* Seidel, W., 15:1185
Fiedler, P.B., The impact of team building and leadership development on nuclear plant performance, 15:345 (J;US)
Fielder, W.L., *See* Singer, J., 15:665
Fields, D.E., Doses to railroad workers from shipments of radioactive materials, 15:205 (J;US)
Figueroa, D., Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT, 15:1654 (RA;BR)
Filges, D., International workshop on calorimeter simulation, 15:1166 (R;DE)
Filinetti, O.B., *See* Storini, M., 15:1556
Finch, F.T., A national laboratory perspective on EOR research and development directions, 15:54 (B;US)
Fingleton, D.J., Siting industrial waste land disposal facilities in Thailand: A risk based approach, 15:1317 (R;US)
See Cadena, F., 15:1254
Fink, J., *See* Rasmussen, R.W., 15:102
Fink, P., *See* He, G., 15:1826
Fink, R.K., ATHENA AIDE, 15:460 (BA;US)
Finkel, J.M., Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)
Finkel, R.C., *See* Buddemeier, R.W., 15:171
Finlay R.W., *See* Marcinkowski, A., 15:1793
Finley, S.J., Characterization and significance of natural fractures in Mesaverde Reservoirs at the Multiwell Experiment site, 15:87 (BA;US)
Firey, B., *See* Coose, J.P., 15:101
Firment, L.E., *See* Hu, B., 15:1857
Fischbach, E., *See* Trampetic, J., 15:1758
Fischer, C.R., Dissociation of O_2 on Cu(001), 15:814 (J;US)
Fischler, M., *See* Deppe, J., 15:1209
Fishbone, L.G., *See* Moran, B.W., 15:213
Fisher, P.W., *See* Gouge, M.J., 15:1919
Fishman, J., Ozone in the tropics: satellite studies, 15:1622 (RA;BR)
Ozone layer and the NASA airbone Antartic experiment of 1987, 15:1624 (RA;BR)
Fishman, S., *See* Koczak, M.J., 15:890
Fisk, P.L., *See* Lux, C.R., 15:507
Fisk, Z., *See* Bazhenov, A.V., 15:850
See Hundley, M.F., 15:861
See Kaplan, S.G., 15:858
See Lynn, J.W., 15:860
Fisman, Carlos, *See* Noto, M.G., 15:966
Fitzgerald, J.B., *See* Ahmad, I., 15:1799
Flake, R.A., Life cycle testing of sodium/sulfur satellite battery cells, 15:584 (BA;US)
Flanagan, G.F., Risk and safety analysis in support of the operation at the High Flux Isotope Reactor at Oak Ridge, 15:484 (R;US)
Flanagan, R.J., *See* Wiebe, L.I., 15:963
Fleming, R.F., *See* Nichols, D.J., 15:1507
Flinchbaugh, T.L., *See* Levine, S.H., 15:479
Flood, D.J., *See* Appelbaum, J., 15:273
See Landis, G.A., 15:248
Flowers, L.T., Application of solar technologies in buildings, 15:280 (R;US)
Floyd, L.M., *See* Cottrell, W.D., 15:1308, 15:1309, 15:1310
See Foley, R.D., 15:1311, 15:1312, 15:1313, 15:1314, 15:1315, 15:1316
Flynn, E.R., *See* Aine, C.J., 15:1402
Fogler, R.J., *See* Moya, M.M., 15:1995
Fokas, A.S., *See* Ablowitz, M.J., 15:1877
Foley, R.D., Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060), 15:1311 (R;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Folga, S., *See* Lyczkowski, R.W., 15:1088
Folsom, B.A., *See* Bartok, W., 15:312
Foppiano, A., Development in predictions of auroral radio wave absorption in the southern hemisphere, 15:1625 (RA;BR)
Foppiano, A.J., *See* Arriagada, M.A., 15:1802
Ford, C.W., *See* Werthen, J.G., 15:288
Ford, W.T., Measurement of α_s from hadron jets in e^+e^- annihilation at $\sqrt{s}$ of 29 GeV, 15:1727 (J;US)
Formby, J.R., Remote location of faulted 11 kV cable sections, 15:325 (R;GB)
Forster, R., *See* Knowles, R.N., 15:1132
Forsyth, R., *See* Grambow, B., 15:183
Fortner, R.L., *See* Toffer, H., 15:528
Foryta, D.W., *See* Afonso, G.B., 15:1676
Foster, K.T., *See* Dickerson, M.H., 15:504
Fowler, M.M., Composite charged particle detectors with logarithmic energy response for large dynamic range energy measurements, 15:1207 (J;NL)
Fox, J., An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Fox, J.D., *See* Furlong, M.W., 15:2
Fox, P.B., *See* Parks, C.V., 15:986
Fox, W.L., *See* Wen, T., 15:1322
Fradkin, L., *See* Bruins, R.J.F., 15:735
See Crumpler, E.P., 15:1357
Fradkin, M.I., *See* Van, N.A.B., 15:1673, 15:1674
Fraenkel-Conrat, H., Nucleoside adducts are formed by cooperative reaction of acetaldehyde and alcohols: Possible mechanism for the role of ethanol in carcinogenesis, 15:1464 (J;US)
Fraker, A., *See* Interrante, C., 15:160
France, J.E., Oxidative coupling catalyst research for the conversion of natural gas to liquid fuels, 15:88 (B;US)
Francis, M.W., *See* Cottrell, W.D., 15:1308, 15:1309, 15:1310
Frank, L.A., *See* Eastman, T.E., 15:1541
See Pickett, J.S., 15:1902, 15:1903, 15:1904
Frankel, K.A., *See* Lo, E.H., 15:1435
Fraunberger, G., Magnetic behavior of $Ce(Cu_{1-x}Ag_x)_6$, 15:809 (J;US)
Frederick, C., Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)

Frederick, W.J., *See* Adams, T.N., 15:699
Frederking, T.H.K., Experiments with metallic and ceramic porous media. Report 30 December 1988, 15:988 (R;US)
Freedman, M.S., A proposed method of measuring the electric-dipole moment of the neutron by ultracold neutron interferometry, 15:1779 (R;US)
Freeman, A.J., *See* Fu, C.L., 15:812
Freeman, H.M., *See* Apel, M.L., 15:721
Freeman, K.H., Isotope Ratio Monitoring Gas Chromatography Mass Spectrometry (IRM-GCMS), 15:1587 (RA;US)
Freitag, M., *See* Kleinwaechter, P., 15:1178
See Winter, G., 15:1179
Freling, M., MATE program: erosion resistant compressor airfoil coating, volume 2. Final report, 15:829 (R;US)
Fritschen, L.J., *See* Whiteman, C.D., 15:1245, 15:1247
Fromm, W.D., Nuclear micro-beam probe for the investigation of surfaces, 15:934 (RA;DD)
On-line programs for multi-parameter measurements, 15:1201 (RA;DD)
See Maerten, H., 15:1197
See Manfrass, P., 15:1184, 15:1405
Fruland, R.M., Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill, 15:1303 (R;US)
Fu, C.L., Covalent bonding of sulfur on Ni(001): S as a prototypical adsorbate catalytic poisoner, 15:812 (J;US)
See Yoo, M.H., 15:765
Fuentes, H.R., *See* Polzer, W.L., 15:154
Fuhrmann, R., Track recognition and track reconstruction in the forward drift chamber of SAPHIR, 15:1159 (R;DE;In German)
Fujii, Y., *See* Thurston, T.R., 15:856
Fujisawa, Kazuya, Accelerated aging test method for a-Si pr module, 15:245 (RA;JP;In Japanese)
Fujita, Hidenori, *See* Jojo, Kazumasa, 15:301
Fuksa, R., *See* Walsh, F., 15:587
Fukuda, Hideo, Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)
Fukuhara, Kaichi, Hydraulic design on shaft-type energy dissipator of head-tank spillway, 15:237 (R;JP;In Japanese)
Fukui, H., *See* Bartlit, J.R., 15:1952
See Enoeda, M., 15:1950
See Ide, T., 15:1945
Fukutome, Atsushi, *See* Yoshimitsu, Tsukasa, 15:318
Fukuzawa, Hisashi, *See* Oyama, Seiichi, 15:228
Fuller, E.L., Evaluation of the consequences of containment bypass scenarios, 15:532 (J;US)
Fullwood, R.R., ANSPipe: An IBM-PC interactive code for pipe-break assessment, 15:515 (J;US)
Fumagalli, S., *See* Zabot, S., 15:281
Funabashi, H., Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
See Lloyd, R.C., 15:1003
See Smolen, G.R., 15:1004
Funk, E.W., *See* Li, N.N., 15:700
Funke, L., *See* Kleinwaechter, P., 15:1178
Furget, C., Constituent approach to high energy elastic scattering of hadrons, 15:1724 (R;FR)
Furlong, M.W., Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989, 15:2 (R;US)
Fursova, T.N., *See* Bazhenov, A.V., 15:850
Furtelli Junior, A., *See* Van, N.A.B., 15:1673
Futamase, Toshifumi, Light propagation and the distance-redshift relation in a realistic inhomogeneous universe, 15:1591 (R;US)
Futch, A.H., A 14-MeV beam-plasma neutron source for materials testing, 15:1971 (R;US)
Futterer, D.K., *See* Wise, S.W., 15:1537
FuWu, J, Process for producing ethanol from plant biomass using the fungus paecilomyces sp, 15:229 (P;US)

G

Gaal, A., *See* Cantor, C.R., 15:1387
Gabutti, A., Improved performance of low-Tc superconductors for detection of minimum-ionizing particles, 15:1161 (R;US)
Gac, F.D., Synthesis and characterization of VLS [vapor-liquid-solid] silicon carbide whisker reinforced reaction bonded silicon nitride, 15:827 (R;US)
Gaertner, K., *See* Wesch, W., 15:1854
Gagnon, A., *See* Takeuchi, K., 15:455
Gahn, R.F., *See* Brewer, J.C., 15:557
Gai, M., Gai replies, 15:1796 (J;US)
Gaines, I., *See* Deppe, J., 15:1209
Galayda, J., *See* Kramer, S.L., 15:1141
Gammel, J.T., MX chains: 1-D analog of CuO planes?, 15:1872 (R;US)
See Loh, E.Y., 15:1852
Ganapol, B.D., Numerical methods: Analytical benchmarking in transport theory, 15:432 (J;US)
See Wilson, J.W., 15:1740
Gant, K.S., The continuing evolution of the Federal Radiological Emergency Response Plan, 15:1422 (R;US)
See Weiss, B.H., 15:482
Ganza, E.A., *See* Herbach, C.M., 15:1190, 15:1191
Garcia, A.L., *See* Mansour, M.M., 15:1741
Garcia, C.J., *See* Sime, D.G., 15:1601
Garcia-Recio, C., Microscopic *s*-wave optical potential for slow pions scattered by a nucleus, 15:1823 (J;US)
Gardner, J.A., *See* Warnes, W.H., 15:807
Gardner, K.E., *See* Savoia, P.J., 15:342
Gardner, R.P., Some geometric modeling and tracking codes for Monte Carlo particle transport including direction biasing techniques, 15:1220 (J;US)
Garg, J.B., *See* Agrawal, H.M., 15:1790
Garg, S., Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)
Garimella, S., *See* Christensen, R.N., 15:1057
Garner, F.A., Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation, 15:798 (R;US)
Garnett, R., Measurement of a mixed spin-spin correlation parameter for *np* elastic scattering, 15:1729 (J;US)
Garrett, J.K., *See* Chidambariah, Venkatesh, 15:732
Garrie Faget, Claudio, *See* Noto, M.G., 15:966
Garrison, J.A., Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
Garrison, K., *See* Bartynski, R.A., 15:811
Garte, S.J., *See* Burns, F.J., 15:1425
Gary, S.P., Electromagnetic waves and instabilities from cometary ion velocity shell distributions, 15:1614 (J;US)
Garzotto, V., *See* Kamperschroer, J.H., 15:1970
Gaspard, P., Sporadicity: Between periodic and chaotic dynamical behaviors, 15:1716 (J;US)
Gathers, G.R., *See* Holmes, N.C., 15:806
Gaudiot, J.L., Token relabeling in a tagged token data-flow architecture, 15:2007 (J;US)
Gaudreau, M.P.J., *See* Chen, M., 15:1883
Gavron, A., *See* Fowler, M.M., 15:1207
Geacintov, N.E., Base sequence effects on interactions of aromatic mutagens with DNA [deoxyribonucleic acid]: Progress report, December 1, 1988–October 15, 1989, 15:1371 (R;US)
Geballe, T.H., *See* Nellis, W.J., 15:800
Gee, J.M., A 31%-efficient GaAs/silicon mechanically stacked, multijunction concentrator solar cell, 15:289 (BA;US)
The effect of parasitic absorption losses on light trapping in thin silicon solar cells, 15:264 (BA;US)
See Kaminar, N.R., 15:291
See King, D.L., 15:263
See MacMillan, H.F., 15:261
See Werthen, J.G., 15:288
Geerk, J., Epitaxial growth and properties of YBaCuO thin films, 15:826 (R;DE)
Geesaman, D.F., Data acquisition for FNAL E665, 15:1134 (J;US)
See Smith, L.C., 15:1783
Geisler, O., *See* Mahrenholtz, O., 15:741
Gelbard, E.M., Acceleration of energy iterations in thermal-hydraulic calculations, 15:449 (J;US)

Geller, A.S., *See* Kraynik, A.M., 15:1058
Gemma, A., *See* Sylvain, C., 15:370
Generazio, E.R., Dynamic porosity variations in ceramics, 15:828 (R;US)
Geohegan, D.B., Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy, 15:1870 (R;US)
George, J.S., *See* Aine, C.J., 15:1402
Georgi, H., *See* Chivukula, R.S., 15:1760
Gerding, T.J., *See* Bates, J.K., 15:872
See Ebert, W.L., 15:138
Gerrels, E.E., *See* Roy, P., 15:670
Gesell, T.F., *See* Carlson, R.D., 15:1839
Ghan, S.J., *See* Covey, C., 15:1238
Gianibelli, J.C., Solar modulation on annual and semi-annual geomagnetic variations, 15:1641 (RA;BR;In Portuguese)
Gibbs, W.R., The creation of high energy densities with antimatter beams, 15:1737 (R;US)
Gikal, B.N., The present status of the U-400 isochronous cyclotron, 15:1094 (R;SU)
Gilbert, H.K., *See* Jackson, S.M., 15:1543
Gill, R.L., *See* Hill, J.C., 15:1789
Gillen, K.T., Predictive aging of elastomers in air: The importance of understanding diffusion-limited oxidation effects, 15:896 (R;US)
Gillham, C.A., United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)
Gilmour, I., Evidence for a single impact at the Cretaceous-Tertiary boundary from trace elements, 15:1480 (RA;US)
Global Cretaceous-Tertiary fire: Biomass or fossil carbon, 15:1482 (RA;US)
Nitrogen geochemistry of a Cretaceous-Tertiary boundary site in New Zealand, 15:1481 (RA;US)
Giner, J., *See* Sarangapani, S., 15:664
Ginley, D.S, *See* Butler, M.A., 15:1078
Giometti, C.S., *See* Thalmann, I., 15:1377
Gippner, P., *See* Boettger, H., 15:1812
Giudice, G.F., Rate for annihilation of galactic dark matter into two photons, 15:1592 (R;US)
Glass, B.P., Late Eocene impact events recorded in deep-sea sediments, 15:1483 (RA;US)
Glasser, A.H., *See* Smith, K., 15:1703
Glazbrook, D.J., A reassessment of criticality safety in the Sellafield separation plant, 15:211 (J;US)
Glazer, J., *See* Chan, J.W., 15:780
See Morris, J.W. Jr., 15:779
Gleason, K., *See* Burnham, A.K., 15:631
Glenn, A.W., *See* Ward, T.E., 15:7
Glick, J.H., *See* Kraynik, A.M., 15:1058
Gloe, K., *See* Langrock, E.J., 15:970
Gloebel, B., Investigations on human blood cells for the diagnosis of radiation damage. Final report, 15:1420 (R;DE;In German)
Gloebel, H., *See* Gloebel, B., 15:1420
Gloeckler, O., Signal validation using simultaneous consistency checking of multivariable measurements, 15:518 (J;US)
Gloudemans, J.R., Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)
Glowienka, J.C., *See* Neilson, G.H., 15:1889
Gobbi, D., Rocket measurements of the OI 557.7 NM and O_2 (0,0) 761,9 NM equatorial emissions, 15:1655 (RA;BR)
Godinez, A., *See* Bravo, S., 15:1679
Godlove, T.F., High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim), 15:1022 (R;US)
Godoy, J.M., *See* Azevedo, H.L., 15:201
Goeltz, R., *See* Tonn, B., 15:1987
Goff, F., *See* Grigsby, C.O., 15:294
Gohs, U., *See* Eckstein, P., 15:1195
Golben, P.M., *See* Rosso, M.J. Jr., 15:668
Goldberg, D.A., Improving the performance of power-limited transverse stochastic cooling systems, 15:1128 (R;US)
Goldblum, S., *See* Herz, R.K., 15:1032
Golden, M.P, Pyramiding tumuli waste disposal site and method of construction thereof, 15:198 (P;US)
Goldenberg, J.F., Contribution to calculation of distribution coefficient of the Uranium using solvent extraction, 15:112 (R;BR;In Portuguese)
Goldstein, B.E., *See* Tsurutani, B.T., 15:1639
Goldstein, M., The 3-D world modeling with updating capability based on combinatorial geometry, 15:1990 (RA;US)
Goldstein, W.H., *See* Bar-Shalom, A., 15:1915
Golub, L., A Normal Incidence X-ray Telescope (NIXT) sounding rocket payload. Final report, 1 November 1982-31 January 1989, 15:1173 (R;US)
Golubovic, L., Nonlinear elasticity of amorphous solids, 15:908 (J;US)
Gomberoff, L., Aspects of broad band electrostatic emissions in the magnetotail, 15:1626 (RA;BR)
Electromagnetic instability below the proton gyrofrequency in large β multicomponent plasmas, 15:1682 (RA;BR)
Ion-ion acoustic waves versus electron-ion acoustic waves, 15:1899 (RA;BR)
Gomez Parada, Ines, *See* Fernandez de Giorgi, Cristina, 15:1433
Gomez, T., *See* Ballard, E.O., 15:1947
Gomi, Hiromi, Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)
Gonczy, J.D., A blanket design, apparatus, and fabrication techniques for the mass production of multilayer insulation blankets for the Superconducting Super Collider, 15:1124 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 2, Laboratory results (300K–80K), 15:1123 (R;US)
See Boroski, W.N., 15:1122
Gonzalez, A.J., *See* Konstantinov, L.V., 15:524
Gonzalez, A.L.C., *See* Dutra, S.L.G., 15:1680
Gonzalez, E.A.M., *See* Rosa, R., 15:1565
Gonzalez, S., *See* Sobral, J.H.A., 15:1668
Gonzalez, W.D., Research in magnetospheric physics at INPE: results and perspectives, 15:1627 (RA;BR)
See Dutra, S.L.G., 15:1680
See Pinto Junior, O., 15:1567, 15:1684
See Pinto, J.R.C.A., 15:1683
See Tsurutani, B.T., 15:1639
Gonzalez-Mestres, L., Cryogenic detectors for particle physics, 15:1168 (R;FR)
Neutrinos, dark matter and low temperature detectors, 15:1726 (R;FR)
See Boniface, J., 15:776
Goodstein, D.L., *See* Pettersen, M.S., 15:914
Gordon, J., *See* Letessier-Selvon, A., 15:1787
Gordon, M.D., *See* Ferrada, J.J., 15:1983
Gordon, W.E., *See* Noble, S.T., 15:1689
Goretta, K.C., *See* Balachandran, U., 15:822
Goudey, G.T., *See* Singh, J.P., 15:848
Gouge, M.J., The CIT [compact ignition tokamak] pellet injection system: Description and supporting research and development, 15:1919 (R;US)
Gough, D.O., *See* Merryfield, W.J., 15:1551
Gould, R., Image reconstruction for a radiation-field mapping system, 15:544 (J;US)
Gousty, Y., *See* Durand, J.L., 15:433
See Peddicord, K.L., 15:434
Gove, N., *See* Baird, B., 15:2001
Gover, J.E., The effects of heavy particle radiation on semiconductor devices, 15:1211 (R;US)
Gozal, A., Improved reactor coolant system overpressure protection using pilot-operated safety, 15:377 (J;US)
Grabbe, C.L., Wave emissions from planetary magnetospheres. Final report, 1 June 1985-31 May 1989, 15:1579 (R;US)
Graciotti, M.E., Nursering assistance to the radiological accident patients in Goiania-an experience report, 15:1434 (R;BR;In Portuguese)
Gradstein, F.M., *See* Jansa, L.F., 15:1492
Graf, H.A., Paramagnetic neutron scattering from Pd_2MnSn, 15:808 (J;US)

Graff, R.A., Steam conditioning of coal for synfuels production: Second quarterly report, April 1–June 30, 1987, 15:4 (R;US)
Graham, R.A., *See* Casey, W.H., 15:1546
Graham, W.G., *See* Schneider, D., 15:1711
Grambole, D., *See* Fromm, W.D., 15:934
Grambow, B., Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions, 15:183 (J;US)
Grant, L., *See* Hardesty, R., 15:786
Grant, L.B., *See* Roddy, D.J., 15:1532
Grassl, H., *See* Petersen, G., 15:1258
Grauer, W.B., *See* Saadatmand, K., 15:1103
Graup, G., Mineralogy and phase-chemistry of the Cretaceous/Tertiary section in the Lattengebirge, Bavarian Alps, 15:1484 (RA;US)
Gray, H., *See* McIntyre, P.M., 15:1114
Gray, J.L., *See* Banghart, E.K., 15:269
Gray, K.E., *See* Gabutti, A., 15:1161
Gray, S.L., *See* Long, E.R. Jr., 15:882
Greathouse, D., Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs, 15:737 (R;US)
Grebogi, C., *See* Bleher, S., 15:1744
Green, L., *See* Kumar, A., 15:1975
Green, L.G., *See* Tarver, C.M., 15:230
Green, M.C., *See* Geesaman, D.F., 15:1134
Greenberg, W., A global existence theorem for the nonlinear BGK equation, 15:1747 (J;US)
Transport equations in weak topologies of dual Banach spaces, 15:1835 (J;US)
Greenberg, W.R., *See* Blunden, P.G., 15:1827
Greene, B.R., Special points in three-generation moduli space, 15:1761 (J;US)
Greene, G.L., Operating team training: Technical training's role, 15:478 (R;US)
Greene, L.H., *See* Jorgensen, J.D., 15:1869
Greene, N.M., The LAW [Library to Analyze Waste] library: A multigroup cross section library for use in radioactive waste analysis calculations, 15:141 (R;US)
Greenwood, L.R, *See* Meadows, J.W., 15:1918
Greenwood, L.R., Measurement of long-lived isotopes and helium production in fusion materials, 15:1922 (R;US)
Greggi, J., *See* Meier, D.L., 15:260
Gregory, E., Conventional wire and cable technology, 15:1010 (J;US)
Greiner, N.R., *See* Blais, N.C., 15:1221
Grewe, S., Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR, 15:1156 (R;DE;In German)
Gribble, R.F., *See* Boenig, H.J., 15:1960
Griest, K., Solitosynthesis: Cosmological evolution of nontopological solitons, 15:1580 (R;US)
Statistical fluctuations as the origin of nontopological solitons, 15:1581 (R;US)
See Giudice, G.F., 15:1592
Griffin, L., Turbine rotor/stator flowfield analysis, 15:1083 (R;US)
Griffith, P., *See* Chou, Y., 15:336
Grifols, J., *See* Gunion, J.F., 15:1752
Grigsby, C.O., Results of investigation at the Miravalles geothermal field, Costa Rica: Part 2, Downhole fluid sampling, 15:294 (R;US)
Grimberg, B.I., Daily asymmetry of magnetic storms of analytical methods, 15:1642 (RA;BR;In Spanish)
Grimberg, B.J., Field longitudinal assymmetry model for geomagnetic storms, 15:1643 (RA;BR;In Portuguese)
Grimes, B.K., *See* Bush, L.L., 15:403
Grinstein, B., *See* Chivukula, R.S., 15:1760
Grisham, L.R., *See* Kamperschroer, J.H., 15:1970
Groetzschel, R., *See* Merla, K., 15:969
Groff, C.R., Pilot RCM application to the Diablo Canyon main stream system, 15:371 (J;US)
Groff, G.C., *See* Flowers, L.T., 15:280
Grohse, E.W., Economical disposal of municipal solid waste with minimal discharges to the atmosphere and maximum recycling of energy and metal values, 15:731 (R;US)
Groot, H., *See* Smit, J., 15:1527
Grosdeva, T., *See* Larchier-Boulanger, J., 15:415
Gross, S., Hydrogen embrittlement in nickel-hydrogen cells, 15:560 (RA;US)
Grossbeck, M.L., Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C, 15:395 (J;US)
[Low activation alloys for fusion reactors]: Foreign trip report, August 13, 1988–August 27, 1988, 15:1966 (R;US)
[Studies on fusion materials]: Foreign trip report, June 5, 1989–June 15, 1989, 15:1963 (R;US)
Grotz, S., *See* Herring, J.S., 15:1935
Groves, A., Design assessment for metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic composite overwind, 15:979 (R;GB)
Gruenhagen, A., NET model coil test possibilities in the TOSKA TWIN configuration, 15:1942 (R;DE)
Gruner, S.M., *See* Anderson, D.M., 15:1382
See Lewis, R.N.A.H., 15:1407
Gsellmann, J., *See* Kordesch, K., 15:671
Gu, Yeming, Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies, 15:1552 (RA;FR)
Guberman, S.L., Introduction to dissociative recombination, 15:1694 (R;US)
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)
Gudiksen, P.H., Categorization of nocturnal drainage flows within the Brush Creek Valley and the variability of sigma theta in complex terrain, 15:1244 (J;US)
See Clements, W.E., 15:1281
See Lange, R., 15:1437
Guenther, F., *See* Gilmour, I., 15:1482
Guenther, R.J., *See* Blahnik, D.E., 15:184
Guidotti, R.A., Evaluation of alternate electrolytes for use in Li(Si)/FeS2 thermal batteries, 15:577 (BA;US)
Guilmette, J., [Shipment of Booster Dipole Vacuum Chambers]: Foreign trip report, August 28, 1989–September 10, 1989, 15:1121 (R;US)
Guinn, K., *See* Herz, R.K., 15:1032
Gulbekyan, G.G., *See* Gikal, B.N., 15:1094
Gundlach, E.R., Review and evaluation of contingency plans for oil and hazardous substances in the upper Great Lakes region. Final report, 15:1326 (R;US)
Gunion, J.F., Higgs bosons in left-right-symmetric models, 15:1752 (J;US)
Gupta, R., *See* Baillie, C.F., 15:1878
Guratzsch, H., *See* Anders, B., 15:1098
Gurnett, D.A., Auroral plasma waves, 15:1688 (R;US)
Gutbrod, H.H., *See* Ritter, H.G., 15:1807
Guth, M.A.S., An expert system design incorporating fuzzy logic for diagnosing heat imbalances in a nuclear power plant, 15:509 (BA;US)
Gutjahr, B., Development and construction of a monitoring system for the central drift chamber of the SAPHIR detector, 15:1155 (R;DE;In German)
Guzik, J.A., *See* Cox, A.N., 15:1613

H

Habegger, L., *See* Fingleton, D.J., 15:1317
Haberstich, A., *See* Schrank, L.S., 15:1955
Haberzettl, H., Separable expansion for the two-body T matrix based on a nonsingular scattering equation, 15:1818 (J;US)
Hachisu, Izumi, The origin of ultra-compact binaries, 15:1583 (R;US)
Hadder, G.R., Navy Mobility Fuels Forecasting System Phase 5 report: Jet fuel conversion by Pacific fuel suppliers and impacts on Navy fuel availability, 15:63 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Impacts of ultra low sulfur diesel fuel production on Navy fuel availability, 15:78 (R;US)
Hagen, C.R., Comment on "Canonical quantum field theory with exotic statistics", 15:1770 (J;US)
Hahn, P.A., *See* Peng, J.L., 15:853
Hahn, Y., Transfer excitation processes in ion-atom collisions at high energies, 15:1710 (J;US)

Haight, R.C., *See* Meadows, J.W., 15:1918
Haire, M., *See* Dorries, T., 15:1138
See Petravick, D., 15:1135
See Pordes, R., 15:1133
Haire, M.J., *See* Koger, K.H., 15:466
Haire, R.G., [Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)
See Nave, S.E., 15:768
Hale, G.M., *See* Young, P.G., 15:1776
Hall, B.E., A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)
Hall, I.K., Status of spent fuel shipping cask development, 15:987 (R;US)
See Chapman, R.L., 15:131
Hall, J.C., *See* Chang, O.K., 15:569
Hall, R., Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)
Hallam, A., End-triassic mass extinction event, 15:1485 (RA;US)
Halliwell, J.W., *See* Neilson, G.H., 15:1889
Hallman, T., *See* Letessier-Selvon, A., 15:1787
Halpert, G., *See* Shen, D.H., 15:567
See Subbarao, S., 15:563
Halzen, F., *See* Cudell, J.R., 15:1753
Hamaker, H.C., *See* MacMillan, H.F., 15:257, 15:261
Hamilton, N., *See* Wise, S.W., 15:1537
Hamm, R.N., *See* Wright, H.A., 15:1423
Hammer, C.F., Confinement Physics Research Facility/ZTH: A progress report, 15:1956 (R;US)
See Boenig, H.J., 15:1960
Hammersley, R.J., *See* Hawley, J.T., 15:489
Hammons, B.E., *See* Vawter, G.A., 15:1040
Hamrick, T.P., Oak Ridge Research Reactor shutdown maintenance and surveillance quarterly report, April, May, and June 1989, 15:477 (R;US)
See Laughlin, D.L., 15:499
Hanada, Kazufumi, Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)
Hancock, G.C., Reaction rates of H(H_2), D(H_2), and H(D_2) van der Waals molecules and the threshold behavior of the bimolecular gas-phase rate coefficient, 15:952 (J;US)
Haney, L.N., *See* Nelson, W.R., 15:508
Haney, S.W., Operating point selection and burn stability control for the International Thermonuclear Experimental Reactor, 15:1908 (R;US)
Hanlon, D., Hazardous-waste-reduction guidelines for environmental-health programs, 15:724 (R;US)
Hannaman, G.W., *See* Briant, V.S., 15:408
Hansen, B.R., *See* King, D.L., 15:263
Hansen, G.E., *See* Spriggs, G.D., 15:120, 15:457
Hanson, D., *See* Fox, J., 15:1255
Hanson, D.J., *See* Chambers, R., 15:522
See Nelson, W.R., 15:511
Harada, Yuichiro, *See* Tani, Tatsuo, 15:271
Harden, R.E., *See* Den Hartog, P.K., 15:1090
Hardesty, D.R., Coal combustion science: Quarterly progress report, April–June 1989, 15:33 (R;US)
Hardesty, R., High temperature Be panel development, 15:786 (R;US)
Hardin, J.E., Laboratory testing of Sonnenschein DF6V180 6 volt traction battery, 15:549 (R;US)
Hardwick, D.A., *See* Caffrey, A.J., 15:1884
Hariyama, Yoshiharu, *See* Morioka, Shinichi, 15:1006
Harjes, H.P., Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988, 15:1542 (R;DE)
Harkness, A.C., Lithium aluminum sulfur dioxide rechargeable system, 15:570 (BA;US)
Harkreader, S., *See* Lee, A.D., 15:654
Harrington, M., *See* Fullwood, R.R., 15:515
Harris, J.H., *See* Neilson, G.H., 15:1889
Harry, H.H, Shaft adjuster, 15:1079 (P;US)
Hart, R.E. Jr., High altitude current-voltage measurement of GaAs/Ge solar cells, 15:268 (BA;US)
Hart, R.J., *See* Tredous, M., 15:1531
Hart, R.S., CANDU-3: Advances in engineering and construction, 15:389 (J;US)
Hartman, M.W., *See* Olin, R.C., 15:1267
Hartmann, R.A., *See* Shanfield, Z., 15:1210
Hartnett, S.L., *See* Reeme, T.L., 15:1327
Hartung, J.B., Manson impact structure, a possible site for a Cretaceous-Tertiary (K-T) boundary impact, 15:1486 (RA;US)
Harunuzzaman, M., Optimal preventive maintenance of a nuclear plant subsystem using dynamic programming, 15:411 (J;US)
Harvey, J.A., *See* Agrawal, H.M., 15:1790
Harwell, J.H., Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)
Haselow, J.S., Savannah River Laboratory Seepage Basins: Waste site assessment report, 15:1305 (R;US)
Haselton, H.H., Applications of neutral beam and RF technologies, 15:1973 (J;US)
Hash, M.C., *See* Bloom, I., 15:550
Hassan Y.A., *See* Kalyanasundaram, M., 15:513
Hassan, M., Utilization of simulation data for control system reliability analysis, 15:462 (J;US)
Hassan, Y.A., *See* Hild, R.D., 15:456
See Salim, P., 15:512
Hassig, P.J., *See* Roddy, D.J., 15:1532
Hastings, J.M., *See* Larese, J.Z., 15:913
Hastings, P., *See* Fingleton, D.J., 15:1317
Hatfield, L., *See* Anderson, R., 15:997
Hauer, A.A., *See* Wark, J.S., 15:915
Hauptman, J., *See* Bengtsson, H., 15:1751
Haustein, P.E., *See* Beavis, D., 15:1203
Hautojaervi, A., Intraval-project test case 5: tracer tests at Finnsjoen. Predictive modelling of the radially converging experiment, 15:179 (R;FI)
Haven, V.E., *See* Ahrenkiel, R.K., 15:906
Hawley, J.T., Study of hydrogen mixing within the Combustion Engineering System 80+ containment, 15:489 (R;US)
Haxton, W.C., Nucleon and nuclear anapole moments, 15:1815 (J;US)
Hayatsu, R., *See* Anderson, K.B., 15:18
See Winans, R.E., 15:19
Hayes, J.M., *See* Freeman, K.H., 15:1587
See Lee, I., 15:957
Hayes, R.E., *See* Ahrenkiel, R.K., 15:907
Hazel, J.E., How many upper Eocene microspherule layers: More than we thought, 15:1487 (RA;US)
He Jianyu, *See* Zhang Qingxuan, 15:919
He, G., Method for computing coupled-channels Gamow-state energies, 15:1826 (J;US)
Headley, L.C., *See* France, J.E., 15:88
Heagle, A.S., *See* Vozzo, S.F., 15:1444
Hearst, J.E., Mutagenesis - fundamental chemistry, 15:1374 (RA;US)
Heath, R.L., Regulation of carbon partitioning in photosynthetic tissue, 15:240 (B;US)
Hebble, T.L., A study of the effect of temperature on the measurement of a hemishell by the development coordinate measuring machine, 15:1001 (R;US)
Hebert, D., *See* Kim, J.H., 15:1187
Hebert, P.S., *See* Duarte, D.S., 15:1000
Hebsur, M.G., Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009, 15:783 (R;US)
Hedgecock, N.S., *See* Ng, E.K., 15:730
Hedrick, C.L., *See* Neilson, G.H., 15:1889
Hedstrom, J.C., *See* Bennett, G.A., 15:1073
Heiberger, J.J., *See* Bloom, I., 15:550
Heinbockel, J.H., Comparison of laser models. Progress report, period ended 15 May 1989, 15:1033 (R;US)
Heinicke, P., *See* Berg, D., 15:1140
Heitbaum, J., *See* Wohlfahrt-Mehrens, M., 15:566
Heller, B.A., *See* Loach, P.A., 15:241
Heller, D.F., *See* Scheps, R., 15:1019, 15:1020
Heller, J.P., Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)
Heller, R., *See* Gruenhagen, A., 15:1942
Helms, R.E., *See* Youngblood, E.L., 15:159

Hendel, H.W., The tokamak as a neutron source, 15:1969 (R;US)
Henderson, G., Energy efficiency in the housing stock, 15:675 (R;GB)
Hendrixson, E.S., Tramp uranium, 15:542 (J;US)
Henley, E.M., *See* Haxton, W.C., 15:1815
Henniger, J., *See* Enghardt, W., 15:1833
Henning, H.M.J., Investigation of ground-based observations of solar oscillations at Stanford, 15:1575 (R;US)
Henning, W., Physics at SIS/ESR, 15:1775 (R;DE)
Henriques, H.P., *See* Nobrega, A.W. da, 15:923
Henry, R.E., *See* Fuller, E.L., 15:532
Henslee, S.P., *See* Tracy, D.B., 15:113
Herbach, C.M., Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy, 15:1778 (RA;DD)
Cone broadening in time-correlated associated-particle method fission cross-section measurements, 15:1782 (RA;DD)
Consideration of the $^{12}C(n,n')3\alpha$-reaction as a background source within a methan filled fission chamber for neutrons of ~ 19 MeV, 15:1192 (RA;DD)
Correlation between fission fragment absorption losses and the plateau height in fission chamber spectra, 15:1832 (RA;DD)
Experimental determination of the $^{3}He(d,p)^{4}He$ background portion in time-correlated associated-particle method (TCAPM) measurements of about 19 MeV neutron energy, 15:1191 (RA;DD)
Optimization of the associated particle (AP) detection system used for time-correlated associated-particle method (TCAPM) fission cross-section measurements in the 4.5 and 8.5 MeV neutron energy range, 15:1190 (RA;DD)
See Merla, K., 15:968
Herchkowitz, N., Experimental investigation of ICRF effects, 15:1928 (R;US)
Herman, Y., Selective extinction of marine plankton at the end of the Mesozoic era: The fossil and stable isotope record, 15:1495 (RA;US)
Hermann, O.W., *See* Brady, M.C., 15:541
Hernandez, R., *See* Figueroa, D., 15:1654
Herndon, J.N., *See* Muller, R.C., 15:991
Hernquist, L., Formation of shell galaxies. II. Nonspherical potentials, 15:1608 (J;US)
Herring, J.S., MSCAP [Magnet System Circuitry Analysis Program] simulations of TESPE magnet safety transients, 15:1931 (R;US)
Safety in the ARIES Tokamak Design Study, 15:1935 (R;US)
The status of superconducting magnet safety research, 15:1934 (R;US)
Herrmann, F., *See* Fromm, W.D., 15:934
Herrmann, M., Space-time effects in the decay of strings by pair-creation, 15:1734 (R;DE)
Hershkowitz, N., Langmuir probe characteristics in RF glow discharges, 15:1217 (J;US)
Hertel, N.E., Dose equivalent and phantoms in conventional calibration practice, 15:1844 (J;US)
Herz, R.K., Design of catalytic monoliths for closed-cycle carbon dioxide lasers. Final report, 15:1032 (R;US)
Herz, W., *See* Gruenhagen, A., 15:1942
Heskett, D., *See* Bartynski, R.A., 15:811
Hesselink, L., Digital image processing in flow visualization, 15:1702 (BA;US)
Hessian, R.T., *See* Fuller, E.L., 15:532
Hetes, R.G., Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Heuer, A.H., High-temperature precipitation hardening of Y_2O_3 partially-stabilized ZrO_2 (Y-PSZ) single crystals, 15:840 (J;US)
Hickman, J.M., Comparison of solar photovoltaic and nuclear reactor power systems for a human-tended lunar observatory, 15:272 (R;US)
Hicks, K., *See* Skulski, W., 15:1821
Hidaka, Y., *See* Yamada, K., 15:855
Higgins, C.A., *See* Wu, M.K., 15:879
Highley, D.E., *See* Fellows, M.E., 15:621
Hild, R.D., Near-wall fluid jet velocity profile measurements using laser speckle velocimetry, 15:456 (J;US)
Hildebrand, A.R., Impact wave deposits provide new constraints on the location of the K/T boundary impact, 15:1488 (RA;US)
Hildebrand, S.G., *See* Sommers, G.L., 15:234
Hill, D., *See* Garnett, R., 15:1729
See Stockli, M.P., 15:1218
Hill, D.M., *See* Wagener, T.J., 15:854
Hill, H.A., *See* Gu, Yeming, 15:1552
Hill, J.C., Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)
Hill, R., *See* Farland, W.H., 15:1462
Hillis, D.L., *See* Neilson, G.H., 15:1889
See Thomas, A., 15:279
Hills, C.R., *See* Scully, J.R., 15:799
Hinchcliffe, G.R., *See* Smith, A.M., 15:306
Hind, G., [Bioproductivity and photosynthesis]: Foreign trip report, September 21–30, 1989, 15:243 (R;US)
Hingerty, B.E., *See* Broyde, S., 15:1375
Hinks, D.G., *See* Dabrowski, B., 15:823
See Pei, S.Y., 15:821
See Wagener, T.J., 15:854
Hinschberger, S.T., *See* Hall, I.K., 15:987
Hinterberger, F., *See* Eversheim, P.D., 15:1125
Hioki, Eiji, *See* Jojo, Kazumasa, 15:301
Hippler, R., Spin effects in slow (H-He)$^+$ collisions, 15:1714 (J;US)
Hiroe, S., *See* Neilson, G.H., 15:1889
Hirooka, Y., *In situ* spectroscopic measurements of erosion behavior of Tokamak Fusion Test Reactor-redeposited carbon materials under high-flux plasma bombardment in PISCES-A (Plasma Interactive Surface Component Experimental Station-A), 15:910 (J;US)
Hiruma, Tsuneyoshi, *See* Fujisawa, Kazuya, 15:245
Hitterman, R.L., *See* Kupperman, D.S., 15:849
Ho, A.Y., *See* Whang, M.H., 15:1909
Ho, N., *See* Knowles, R.N., 15:1132
Ho, P., Glow-discharge synthesis of silicon nitride precursor powders, 15:845 (J;US)
Hoard, D.E., *See* Clements, W.E., 15:1242
See Stone, G.L., 15:1241
Hoberecht, M.A., *See* Jimenez, A.P., 15:278
Hockney, G., *See* Constanta-Fanourakis, P., 15:1136
Hodgers, J., *See* Agostini, R.C., 15:1014
Hodgson P.E., *See* Marcinkowski, A., 15:1793
Hodgson, K.M., *See* Chiarizia, R., 15:1345
Hoeller, T.L., *See* Varma, R., 15:801
Hoess, J.A., Minimum-weight highway transporters for nuclear spent-fuel casks, 15:132 (J;US)
Hoffman, D.J., *See* Caughman, J.B.O. II, 15:1925
Hoffman, F.O., [Environmental transport of radionuclides]: Foreign trip report, September 14–26, 1989, 15:1285 (R;US)
Hoffman, H., Horizontal cold source: Experimental cooling tests of the horizontal cold source cell with nitrogen gas, 15:427 (TG;US)
Hoffman, J.M., A comparison of TLD and Monte Carlo calculation for beta dosimetry, 15:1846 (J;US)
Hoffmann, C.L., [Structural design criteria for HTGR reactors]: Foreign trip report, January 29, 1989–February 3, 1989, 15:384 (R;US)
Hoffmann, H., Experimental evaluation of the liquid deuterium fill fraction of the horizontal cold source moderating cell, 15:387 (TG;US)
Tests on wall temperatures of the moderator cell of the D_2 cold source in equilibrium and transient regimes, 15:388 (TG;US)
Thermodynamic and fluid dynamic experiments for the horizontal cold source of the Grenoble high flux reactor, 15:386 (TG;US)
Hoffmann, J., *See* Gelbard, E.M., 15:449
Hofman, G.L., *See* Pahl, R.G., 15:392
Hofmann, A., *See* Gruenhagen, A., 15:1942
Hofmann, P., *See* Kuczera, B. Hagen, S., 15:533
Hogan, J.T., *See* Peng, Y.K.M., 15:1888
Hohimer, J.P., *See* Vawter, G.A., 15:1040
Hok, C.I., *See* Zarling, J.P., 15:1414, 15:1415
Holder, G.D., Novel experimental studies for coal liquefaction: Final report, 15:5 (R;US)
Holland, D.F., Safety and environmental analysis of the compact ignition tokamak, 15:1939 (R;US)
See Brereton, S.J., 15:1932

Holloway, J.P., Spatially nonuniform traveling waves bifurcating from single-humped Vlasov equilibria, 15:1910 (J;US)
Holmes, N.C., The equation of state of platinum to 660 GPa (6.6 Mbar), 15:806 (J;US)
See Mitchell, A.C., 15:1604
Holmes, R.R., Vacuum plasma spray coating, 15:757 (RA;US)
Holtz, M.J., *See* Blum, S., 15:685
Holzmann, R., *See* Ahmad, I., 15:1799
Hong, B.S., *See* Wilson, J.W., 15:1740
Hoover, C.G., *See* Hoover, W.G., 15:1067
Hoover, D.L., Preliminary description of quaternary and late pliocene surficial deposits at Yucca Mountain and vicinity, Nye County, Nevada, 15:172 (R;US)
Hoover, W.G., Simulation of mechanical deformation via nonequilibrium molecular dynamics, 15:1067 (R;US)
Hopenfeld, J., *See* Beahm, E.C., 15:356
Hopkins, W.E., *See* Dickinson, B.W., 15:1979
Horner, R., Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)
Horning, W.B., *See* Weber, C.I., 15:1446
Horschel, D.S., Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
Horton, L.D., *See* Neilson, G.H., 15:1889
Horvath, J.J., Nitric acid oxide mixing ratio measurements using a rocket launched chemiluminescent instrument. Final technical report, September 1986-October 1987, 15:1259 (R;US)
Horvath, S.M., Maximal aerobic capacity at several ambient concentrations of carbon monoxide at several altitudes. Research report, April 1984-January 1988, 15:1274 (R;US)
Horwitz, E.P., *See* Chiarizia, R., 15:1345
Hosselet, S.C., The effect of radiation penetration on DNA single-strand breaks in rat skin explants, 15:1426 (R;US)
Hostetler, L.D., *See* Moya, M.M., 15:1995
Hostick, C.J., Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
See Lavender, J.C., 15:206
Hotchkiss, M.A., *See* Ahmad, I., 15:1799
Hou, P.Y., The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)
Houlberg, L.M., Environmental regulatory update table, 15:1299 (R;US)
Environmental Regulatory Update Table, September 1989, 15:1300 (R;US)
Housen, K.R., *See* Schmidt, R.M., 15:1519
Howe, H.C., *See* Neilson, G.H., 15:1889
Howe, T.M., Evaluation of ANF fuel failures in oyster creek, 15:344 (J;US)
Howell, J.A., The accelerator automation application toolkit workshop presentations, 15:1095 (R;US)
Howells, M.R., *See* McNulty, I., 15:1107
Hrbek, J., [Brief highlights of the Eleventh international vacuum congress]: Foreign trip report, September 23–30, 1989, 15:937 (R;US)
Hseuh, H.C., [The AGS Booster Vacuum Systems]: Foreign trip report, September 23, 1989–October 4, 1989, 15:1116 (R;US)
Hsiang, T.Y., *See* Zhou, X., 15:911
Hsiao Mingyuan, CFRX, a one-and-a-quarter-dimensional transport code for field-reversed configuration studies, 15:1911 (J;NL)
Hsieh, H., *See* Schuchman, J.C., 15:1106
Hsu, L., Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)
Hsue, K.J., Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause, 15:1489 (RA;US)
Hsueh, S.Y., *See* Trost, L.H., 15:1728
Hu, B., Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)
Hu, P.S., A comparative study of six data sources' ability for estimating interstate motor carrier VMT [vehicle miles of travel], 15:1466 (R;US)
See Davis, S.C., 15:696
Hu, Q., *See* Richards, P.L., 15:1011
Hu, Y., *See* Wagener, T.J., 15:854
Huang, C.K., *See* Subbarao, S., 15:563
Huang, C.Y., *See* Eastman, T.E., 15:1541
See Wu, M.K., 15:879
Hubbell, J.M., *See* McElroy, D.L., 15:1318
Hubert, P.A., Energy use comparison between conventional reconstruction and hot-drum mix recycling for major trunk roads. A demonstration by Kent County Council. [Maidstone], 15:710 (R;GB)
Huddleston, S.W., *See* Boenig, H.J., 15:1960, 15:1961
Hudson, D.A., *See* Davis, F.G., 15:818
Huffman, A.R., Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean, 15:1490 (RA;US)
Hughes, D.E., *See* Levine, S.H., 15:479
Hui, Chofat, *See* Mathew, M.K., 15:1388
Hulet, E.K., Biomodal spontaneous fission, 15:1791 (R;US)
Hull, A.P., Update and comparisons of dose estimates following the Chernobyl accident, 15:536 (J;US)
Hulstrom, R.L., SERI [Solar Energy Research Institute] Resource Assessment Project: FY 1987 annual progress report, 15:239 (R;US)
Hummel, K.E., Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
Humphrys, B.L., *See* Koger, K.H., 15:466
Hundley, M.F., Bulk superconductivity above 30 K in T^*-phase compounds, 15:861 (J;US)
Hunt, C.E.L., *See* Mulpuru, S.R., 15:519
Hunter, J.W., *See* Nellis, W.J., 15:800
Hurst, C.A., *See* Evans, J.W., 15:953
Hurst, J.B., Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
Hurst, R.B., *See* Ford, W.T., 15:1727
Husar, R.B., Trends of seasonal haziness and sulfur emissions over the eastern US, 15:1275 (R;US)
Husby, D., *See* Deppe, J., 15:1209
Huth, J., Three-dimensional survey techniques for large detector systems, 15:1204 (J;NL)
Hutton, J.L., A hybrid Monte Carlo method, 15:447 (J;US)
Hwang, R.N., A rigorous pole representation of multilevel cross sections and its practical applications, 15:465 (J;US)

I

Iachello, F., The role of dynamic symmetries and supersymmetries in nuclear physics, 15:1814 (J;US)
Iannello, V., Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989, 15:980 (R;US)
Ibrahim, M.B., Two-dimensional numerical simulation of a Stirling engine heat exchanger, 15:1054 (R;US)
Ice, G.E., *See* Sparks, C.J., 15:1848
Ichikawa, Tatsumi, ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)
Ida, Toshio, An expert system for PWR core operation management, 15:467 (J;US)
Ide, T., $NaNi_3Mn_2$ alloy as a tritium storage material, 15:1945 (R;US)
See Bartlit, J.R., 15:1952
See Enoeda, M., 15:1950
Igarashi, Toshifumi, *See* Mahara, Yasunori, 15:1350
Iglesias, C.A., *See* Rogers, F.J., 15:1603
Iglesias, F.C., *See* Mulpuru, S.R., 15:519
Igo, G., *See* Letessier-Selvon, A., 15:1787
Ihle, E., Calculation of concentration profiles and their experimental verification with a pulsed sieve-plate column and the reactive material system of uranyl nitrate, nitric acid/tributyl phosphate, kerosine, 15:122 (R;DE;In German)
Ikeda, Y., *See* Meadows, J.W., 15:1918
Iljin, A.I., Fast discriminator with low-level threshold, 15:1198 (RA;DD)
Im, K.H., *See* Ahluwalia, R.K., 15:300
Imai, M., *See* Miura, Y., 15:1504
Imbriale, W.A., *See* Calalo, R.H., 15:1830
Inokuti, Mitio, Radiation physics as a basis of radiation chemistry and biology, 15:1834 (BA;US)

Inoue, Atsuyuki, Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
Inoue, Toshio, *See* Ichikawa, Tatsumi, 15:320
Internoscia, M.A., *See* Bloom, I., 15:550
Interrante, C., Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988, 15:160 (R;US)
Intrator, T., *See* Hershkowitz, N., 15:1217
Iozzi, F.B., Chemical analysis by X-ray fluorescence, of niobium in high-strength plate steels, 15:927 (R;BR;In Portuguese)
Irving, P.M., Assessment of the importance of acidic fogwater and cloudwater in affecting terrestrial vegetation: Some important case studies, 15:1256 (R;US)
Isaac, K.M., Modeling of hydrogen-air diffusion flame. Interim report, 15:975 (R;US)
Isayama, Y., Isotopic effects on solubility-limited mass transfer, 15:156 (R;US)
Isely, M., *See* Deppe, J., 15:1209
Ishii, M., *See* Tan, M.J., 15:428
Ishikawa, T., *See* Oversluizen, T., 15:1105
Ishitsuka, M., *See* Kitamura, T.-J., 15:1631
Isler, R.C., *See* Neilson, G.H., 15:1889
Ivanov-Kholodny, G.S., Modern problems in physics of variations of the ionosphere at the altitudes 100-200 Km, 15:1628 (RA;BR)
Iyer, S.S., *See* Babinski, M., 15:1472
Izett, G.A., Western North American Cretaceous-Tertiary (K-T) boundary interval and its content of shock-metamorphosed minerals: Implications concerning the K-T boundary impact-extinction theory, 15:1491 (RA;US)
Izumida, Tatsuo, *See* Takahashi, Masanori, 15:187

J

Jacak, B.V., *See* Fowler, M.M., 15:1207
Jachic, J., Components of neutronic state for calculating the phase library in the neutronic simulation of a low power experimental fast reactor, 15:476 (R;BR;In Portuguese)
Jachich, J., Two-dimensional suboptimal calibration of the shadow factors in the experimental fast reactor-BR-82, 15:425 (R;BR;In Portuguese)
Jackson, A., *See* Kramer, S.L., 15:1141
Jackson, B.V., Scientific background and design specifications for a near-earth heliospheric imager. Final report, 1 March 1985-30 September 1987, 15:1547 (R;US)
Jackson, K.J., *See* Wolery, T.J., 15:1544
Jackson, S.M., The 1988 INEL [Idaho National Engineering Laboratory] microearthquake survey near the western edge of the eastern Snake River Plain, 15:1543 (R;US)
Jacobi, N., *See* Calalo, R.H., 15:1830
Jacobl, W.J., Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989, 15:1070 (R;US)
Jacobs, G.K., *See* Spalding, B.P., 15:165
Jacobs, J.J., *See* Awaluddin, A., 15:1396
Jacobs, R.A., Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)
Jacobsen, C., *See* McNulty, I., 15:1107
Jacobsen, C.J., *See* Thomas, M.M., 15:1215
Jacobson, A.J., *See* Pei, S.Y., 15:821
Jacoby, B.A., *See* York, T.M., 15:1002
Jacoby, J., Studies on the production of high energy densities in matter by intense heavy-ion beams, 15:1895 (R;DE;In German)
Jaeger, C.A., A null-type instrument for on-line boron analysis, 15:364 (J;US)
Jaeger, E.F., *See* Carter, M.D., 15:1926
Jahan, M.S., Environmental effects on luminescence yield of superconducting $YBa_2Cu_3O_x$, 15:842 (J;US)
Jahanmir, S., Development and use of a tribology research-in-progress data base, 15:1064 (R;US)
Jahnke, S., Automatic reactor protection system tester, 15:374 (J;US)
Jahr, R., *See* Siebert, B.R.L., 15:1845
Jalbert, R., *See* Tesini, A., 15:1962
Jalbert, R.A., *See* Bartlit, J.R., 15:1952
James, R.H., *See* Finkel, J.M., 15:25
Jameson, I., *See* Aubrey, D.R., 15:324
Jamieson, D.N., *See* Bowman, R.C. Jr., 15:869
Jang, Dujeon, Deprotonation of lipid-depleted bacteriorhodopsin, 15:1383 (J;US)
Janik, G.R., Isotopically selective optical deflection of a krypton atomic beam, 15:1706 (J;US)
Janofsky, V.V., *See* Andronenko, L.N., 15:1183
Janoki, A., In vivo stability and inertness of various direct labelled and chelate-tagged protein., 15:1401 (RA;AR)
Jansa, L.F., Mass mortality and extraterrestrial impacts, 15:1492 (RA;US)
Janssens, R.V.F., *See* Ahmad, I., 15:1799
Jardin, S.C., *See* Bathke, C.G., 15:1901
See Peng, Y.K.M., 15:1888
Jarrell, M., *See* Chakraborty, A., 15:865
Jarrett, J., *See* Coates, J.F., 15:592
Jassby, D.L., *See* Hendel, H.W., 15:1969
Jayaprakash, C., *See* Sarker, S., 15:1866
Jee, C.S., *See* Kebede, A., 15:851
Jefferies, K.S., Concentration of off-axis radiation by solar concentrators for space power, 15:285 (R;US)
Jeffries, J.B., *See* Rensberger, K.J., 15:978
Jeneveau, A., *See* Peddicord, K.L., 15:434
Jenkins, C.F., *See* Corbett, R.A., 15:176
Jenkins, M.G., Empirical and analytical determination of the fracture resistance of a TiB_2 particle/SiC matrix composite, 15:824 (R;US)
Jennings, D.A., *See* Schneider, M., 15:1035
Jenquin, U.P., *See* Blahnik, D.E., 15:184
Jensen, M., *See* Hardesty, R., 15:786
Jentzsch, K., *See* Gruenhagen, A., 15:1942
Jerman, P.C., Review of activities of the national commitee on radiation protection, 15:1431 (R;US)
Jernigan, T.C., *See* Neilson, G.H., 15:1889
Jette, D.C., *See* Wiebe, L.I., 15:963
Jiang DongLing, *See* Zhang Qingxuan, 15:919
Jimenez, A.P., Space station freedom photovoltaic power module design status, 15:278 (R;US)
Jin, Y., *See* Chou, W., 15:1142
Joardar, K., Minority carrier lifetime degradation in Si concentrator solar cells, 15:290 (BA;US)
Joestlein, H., *See* Mulderink, H., 15:1163
Johnson, A.B. Jr., Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)
Johnson, A.J., *See* Petersen, R.D., 15:169
Johnson, C.A., Oversight-a key ingredient in the HLW repository program, 15:186 (J;US)
Johnson, D.H., *See* Flanagan, G.F., 15:484
Johnson, D.W., Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies, 15:1306 (J;US)
See Lindberg, S.E., 15:1262
Johnson, E.R., *See* Moran, B.W., 15:213
Johnson, F.T., Modular construction approach for advanced nuclear plants, 15:372 (J;US)
Johnson, K.F., *See* Garnett, R., 15:1729
Johnson, L., *See* Corsberg, D., 15:459
Johnson, L.R., Beneficiation-hydroretort processing of US oil shales, engineering study: Volume 3, Final report, 15:106 (R;US)
Johnson, R.P., *See* Maynard, R.L., 15:1037
See Stanley, J.G., 15:1038
Johnson, R.W., Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988, 15:3 (R;US)
Johnson, S.L., *See* Anderman, M., 15:571
Johnston, A.R., *See* Kirkham, H., 15:307
Johnston, D.C., *See* Lee, W.C., 15:846
Johnston, T.W., *See* Drake, R.P., 15:1916
Jojo, Kazumasa, Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
Jolley, R.L., Trace substances present as chlorination by-products in drinking and process waters, 15:1342 (J;US)
Jona, F., *See* Li, H., 15:815
Jones, D.D., *See* Wdowiak, T.J., 15:1535

Jones, E.M., *See* Dickel, J.R., 15:1611
Jones, H.W., Analytical evaluation of the electrostatic potential for diatomic molecules, 15:1691 (R;US)
Jones, J.L., *See* Herring, J.S., 15:1931
Jones, K.L., *See* Carlson, R.D., 15:1839
Jones, K.M., *See* Ahrenkiel, R.K., 15:906
Jones, K.W., *See* Chen, J.R., 15:1212
See Hu, B., 15:1857
Jones, M., Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)
Jones, P.D., Antarctic surface temperature and pressure data, 15:1239 (R;US)
Jones, R.R., *See* Briggs, J.B., 15:490
Jonsson, A., *See* Beaudreau, J.J., 15:362
Jordan, H., *See* Mings, W.J., 15:130
Jorgensen, J.D., Charge transfer and bond lengths in $YBa_2Cu_{3-x}M_xO_{6+y}$, 15:1869 (R;US)
Structural studies at high pressure using time-of-flight neutron powder diffraction, 15:1828 (R;US)
See Dabrowski, B., 15:823
See Pei, S.Y., 15:821
Joseph, D., Comparison between photo- and hadroproduction of rho^0 mesons at the CERN-OMEGA spectrometer, 15:1723 (R;DE;In German)
Joshua, A.V, Synthesis and biodistribution of some radioiodinated diamines, 15:1397 (RA;AR)
Jost, M.B., *See* Wagener, T.J., 15:854
Jou, C.J., Formation of coherent twins in $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:843 (J;US)
Judkins, R.R., [Materials for hot gas cleanup in coal conversion and utilization systems]: Foreign trip report, May 31, 1988–June 16, 1988, 15:10 (R;US)
Juengst, K.P., *See* Herring, J.S., 15:1931
Juengst, Klaus-Peter, *See* Herring, J.S., 15:1934
Juhasz, A., *See* Swanson, T.D., 15:1056
June, C., *See* Spielberg, H., 15:1417
Juricic, I., *See* Beavis, D., 15:1203

K

Kackley, N., *See* Swette, L., 15:663
Kaczar, K., *See* Constanta-Fanourakis, P., 15:1136
See Petravick, D., 15:1135
Kadotani, Hiroyuki, *See* Morioka, Shinichi, 15:1006
Kai, L., *See* Afonso, G.B., 15:1676
Kakurai, K., *See* Thurston, T.R., 15:856
See Yamada, K., 15:855
Kalal, P., *See* Kordesch, K., 15:671
Kalbeitzer, F.L., *See* Carlson, R.D., 15:1839
Kalinin, A.A., Investigation of the influence material on initial stages of epitaxial growth of $Pb_{0.8}Sn_{0.2}Te$ layer during the growing from solution-melt, 15:942 (RA;SU;In Russian)
Kaltenhaeuser, A., Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report, 15:1419 (R;DE;In German)
Kalyanasundaram, M., Analysis of loss-of-feedwater transients in MB-2 using RELAP5/MOD2, 15:513 (J;US)
Kamal, S.A., Three-dimensional bowing analysis of radial reflector assemblies in advanced LMRS, 15:390 (R;US)
Kamalov, S.S., *See* Chumbalov, A.A., 15:1735, 15:1736
Kamegai, M., Micro-scale simulation of dynamic compaction of oxide and metal powder mixture, 15:837 (R;US)
Kamin, G., *See* Avery, R.K., 15:1129
Kaminar, N.R., Concentrator efficiencies of 29.2% for a GaAs cell and 24.8% for a mounted cell-lens assembly, 15:291 (BA;US)
See MacMillan, H.F., 15:261
See Werthen, J.G., 15:288
Kaminski, P., *See* Drozdz, S., 15:1879
Kamkin, A.N., *See* Kalinin, A.A., 15:942
Kamperschroer, J.H., Cryosorption of helium on argon frost TFTR [Tokamak Fusion Test Reactor] neutral beamlines, 15:1970 (R;US)
Kampert, K.H., *See* Ritter, H.G., 15:1807
Kane, G.L., *See* del Aguila, F., 15:1745
Kang, J.S., *See* Shen, Z.X., 15:1873
Kantor, I.J., Ionospheric electron temperature rocket measurements with langmuir probe over Natal, Brazil, in 1985, 15:1897 (RA;BR)
See Muralikrishma, P., 15:1660
See Paula, E.R. de, 15:1665
Kapil, S.K., Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)
Kapitulnik, A., *See* Lindberg, P.A.P., 15:847, 15:857
See Wells, B.O., 15:863
Kaplan, S., *See* Flanagan, G.F., 15:484
Kaplan, S.G., Antiferromagnetic resonance in La_2CuO_{4+y}, 15:858 (J;US)
Kapulla, H., *See* Gruenhagen, A., 15:1942
Kar, A., *See* Mazumder, J., 15:754
Karadjov, D., On the influence of the quadrupole pairing on the energies of the two-quasiparticle states in deformed nuclei, 15:1803 (R;SU)
Karalus, J.L., Risks versus savings in the international spot market, 15:133 (J;US)
Karwowski, H.J., *See* Skulski, W., 15:1821
Kaschmitter, J., Wafer scale RISC [Reduced Instruction Set Computer] processor, 15:1997 (R;US)
Kasik, R.J., *See* Reass, W.A., 15:1953
Kasting, J., *See* Zahnle, K., 15:1540
Kastner, M.A., *See* Thurston, T.R., 15:856
See Yamada, K., 15:855
Katcoff, S., *See* Beavis, D., 15:1203
Kathat, C.L., Second class currents in the μ^--capture by polarized light nuclei, 15:1804 (R;SU)
Katzman, M.T., How far can the world get on energy efficiency alone?, 15:588 (R;US)
Kaufman, S., *See* Geesaman, D.F., 15:1134
Kaufman, S.B., *See* Beavis, D., 15:1203
Kaul, D.C., Fluence-to-dose conversion factor standards, 15:540 (J;US)
See Cousins, T., 15:1847
Kawamura, Fumio, *See* Takahashi, Masanori, 15:187
Kawashita, K., Geochronological data for lithostratigraphic complexes of a crystalline basement from the South regions of Minas Gerais and adjacent areas of the Sao Paulo state, 15:1471 (R;BR;In Portuguese)
See Babinski, M., 15:1472
See Tassinari, C.C.G., 15:1469
See Teixeira, W., 15:1470
Kayser, B., *See* Gunion, J.F., 15:1752
Keating, T., Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)
Kebede, A., Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$, 15:851 (J;US)
Keimer, B., *See* Tranquada, J.M., 15:852
Keiseler, D., Temperature control of analyzer crystals in crystal diffraction spectrometers with discontinuous optimized controllers, 15:1194 (RA;DD)
Keller, H.J., Fortran programs KASSAMBA and STRIDEM, 15:1811 (RA;DD)
See Kotte, R., 15:1181
Keller, H.W., *See* Kapil, S.K., 15:361
Kellogg, L.S., *See* McElroy, W.N., 15:351
Kelly, A.P., *See* Johnson, R.W., 15:3
Kelly, J.E., *See* Dingman, S.E., 15:340
Kempf, F.J., *See* Skogen, F.B., 15:343
Kenna, B.T., Studies of the adsorption/desorption behavior of explosive-like molecules, 15:1222 (R;US)
Kennedy, J.E., NRC overview: Repository QA, 15:194 (J;US)
Kennedy, R.P., *See* Short, S.A., 15:506
Kennedy, W.E. Jr., Development of international exemption principles for recycle and reuse, 15:500 (R;US)
Kennett, J.P., *See* Asaro, F., 15:1475

See Stott, L.D., 15:1528
See Wise, S.W., 15:1537
Kenney, E.S., *See* Gould, R., 15:544
See Kurilla, R.G., 15:463
Kephart, J.O., Measurement of the occupation lengths of channeled 17-MeV electrons and 54-MeV electrons and positrons in silicon by means of channeling radiation, 15:1862 (J;US)
Keskinen, M.J., Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report, 15:1618 (R;US)
Kessler, F.A., *See* Weber, C.I., 15:1446
Ketelle, R.H., *See* Lee, R.R., 15:1302
Ketterson, J.B., *See* Mattson, J., 15:764
Kewish, R.W., *See* Pollat, L.L., 15:1946
Keyes, B., *See* Ahrenkiel, R.K., 15:907
Khan, F., *See* Wilson, J.W., 15:1740
Khandhar, P.K., *See* Frederking, T.H.K., 15:988
Khare, B.N., Organic solids produced from simple C/H/O/N ices by charged particles - Applications to the outer solar system, 15:1609 (J;US)
Khedari, J., Delayed thermal supply in a building using a heat collector and storage porous concrete wall, 15:282 (R;FR;In French)
Khoo, T.L., *See* Ahmad, I., 15:1799
Kibbler, A.E., *See* Olson, J.M., 15:270
Kibblewhite, M.G., Calibration and quality assurance for dioxin analysis, 15:1447 (R;GB)
Kidman, R.B., *See* Cox, A.N., 15:1613
Kientz, K.L., *See* Wen, T., 15:1322
Kikuchi, S., [Japan Atomic Energy Research Institute] progress report, July 1988–June 1989, 15:1808 (R;JP)
Kilgroe, J.D., *See* Linak, W.P., 15:736
Killing, U., Pulsed TIG welding of pipes. Final report, 15:773 (R;DE;In German)
Kilpelaeinen, H., Use of peat in wood adhesives, 15:16 (R;FI;In Finnish)
Kim, J.H., Investigations with the aim of installation a low-level γ-spectrometer, 15:1187 (RA;DD)
Kim, J.S., *See* Fraunberger, G., 15:809
Kim, S., *See* Kramer, S.L., 15:1109
Kim, S.T., A discrete nodal transport method for cylindrical geometry, 15:1837 (J;US)
Kim, T., *See* Schuchman, J.C., 15:1106
Kimball, O.F., [High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)
Kimura, M., *See* Hippler, R., 15:1714
Kindsfather, R.R., *See* Stewart, K.A., 15:1976
King, C.W., Representativeness of single vertical wind profiles for determining volume flux in valleys, 15:1243 (J;US)
See Neff, W.D., 15:1248
King, D.B., *See* Thome, F., 15:1076
King, D.L., Measurement precautions for high-resistivity silicon solar cells, 15:263 (BA;US)
King, K.H., *See* Chidambariah, Venkatesh, 15:732
Kirchhoff, V.W.J.H., Ozone measurements in Brazil, 15:1629 (RA;BR)
Present status of the ozone layer, 15:1630 (RA;BR)
See Pinto Junior, O., 15:1684
Kiritsis, E., Yukawa theories as effective theories of quantum chromodynamics for a large number of colors, 15:1816 (J;US)
Kirk, B.L., Hypercube applications of the x-y geometry nodal method for the neutron diffusion equation, 15:439 (J;US)
Kirk, P., *See* Letessier-Selvon, A., 15:1787
Kirkham, H., Extending the service life of 15KV polyethylene URD cable using silicone liquid, 15:307 (J;US)
Kirtley, J.L., Application of superconductors to motors, generators, and transmission lines, 15:1009 (J;US)
Kirz, J., *See* McNulty, I., 15:1107
Kitamura, T.-J., Peculiarity of the equatorial ULF, 15:1631 (RA;BR)
Kitauchi, Yoshihiro, *See* Jojo, Kazumasa, 15:301
Kitazaki, K.S., *See* Shanfield, Z., 15:1210
Kitchell, J.A., *See* MacLeod, N., 15:1499
Kiara, S.M., *See* Enick, R.M., 15:57
Klare, K.A., *See* Schrank, L.S., 15:1955
Klasky, M., *See* Peng, Y.K.M., 15:1888
Klavins, P., *See* Peng, J.L., 15:853
Klein, J.W., The importance of batteries in unmanned missions, 15:551 (RA;US)
Klein, R.K., *See* Kephart, J.O., 15:1862
Kleinschmidt, A., *See* Buschmann, H., 15:1421
Kleinwaechter, P., Development and test of a ΔE - E annular detector telescope, 15:1178 (RA;DD)
Klemm, R.A., *See* Lee, W.C., 15:846
Klevans, E.H., *See* Shillenn, J.K., 15:412
Klingner, P.L., *See* Wilkins, R.W., 15:1957
Klivenyi, G., *See* Janoki, A., 15:1401
Klots, C.E., *See* Wright, H.A., 15:1423
Klotz, D., Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III, 15:150 (R;DE;In German)
Knapp, M.R., Low-level waste management, 15:191 (J;US)
Kneifel, B., *See* Gruenhagen, A., 15:1942
Knight, S., *See* Meijaer, A., 15:155
Knoesen, A., *See* Mortazavi, M.A., 15:912
Knoll, J., *See* Herrmann, M., 15:1734
Knoll, J.E., *See* Finkel, J.M., 15:25
Knowles, R.N., Expert systems tactics in testing Fastbus Segment Interconnect modules: Lessons so far in the SIDES project, 15:1132 (J;US)
Knutson, C.F., *See* Smith, R.P., 15:104
Kobayashi, A.S., *See* Jenkins, M.G., 15:824
Kobayashi, S., *See* Yokote, Mitsuhiro, 15:359
Koch, R., *See* Nellis, W.J., 15:800
Koch, V.R., *See* Dominey, L.A., 15:568
Koczak, M.J., Inorganic composite materials in Japan: Status and trends, 15:890 (R;US)
Koeberl, C., Volcanic ash layers in blue ice fields (Beardmore Glacier Area, Antarctica): Iridium enrichments, 15:1493 (RA;US)
Koehler, H., Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)
Koelling, D.D., $CeRu_2Si_2$ and URu_2Si_2: Same or different?, 15:870 (R;US)
Koenig, A.A., Sodium sulfur cell design considerations for power applications, 15:583 (BA;US)
Koenigsberger, G., *See* Auer, L.H., 15:1569
Koeppel, P., *See* Buschmann, H., 15:1421
Koger, K.H., The centralized reliability data organization (CREDO) assessment of critical component unavailability in liquid-metal reactors, 15:466 (J;US)
Kohgi, M., *See* Graf, H.A., 15:808
Kohl, H., *See* Figueroa, D., 15:1654
Kohn, E., *See* Dick, J.E., 15:534
Kohse-Houinghaus, K., *See* Rensberger, K.J., 15:978
Kojima, Akira, *See* Sano, Kenichi, 15:546
Kojima, Yukio, *See* Taniguchi, Haruhito, 15:313
Kolar, J., *See* Grigsby, C.O., 15:294
Kolb, B., *See* Ritter, H.G., 15:1807
Kolb, E.W., *See* Griest, K., 15:1580, 15:1581
Kolesnikov, E.M., Karskiy craters are the probable records of catastrophe at the Cretaceous-Tertiary boundary, 15:1494 (RA;US)
Kollenberg, W., Principles and methods for the testing of high-performance ceramics. A survey, 15:1063 (R;DE;In German)
Komarek, P., *See* Gruenhagen, A., 15:1942
Komvopoulos, K., *See* Suh, N.P., 15:1062
Kong, X.P., Anomalous diffusion in a lattice-gas wind-tree model, 15:1863 (J;US)
Konishi, S., *See* Ide, T., 15:1945
Konkel, H.E., *See* Boenig, H.J., 15:1960, 15:1961
Konno, C., *See* Meadows, J.W., 15:1918
Konopka, A.E., *See* Turco, R.F., 15:1334
Konstantinov, L.V., The radiological impact of the Chernobyl accident, 15:524 (J;US)
Koopman, R.P., *See* Schatz, K.W., 15:727
Koppe, R.H., The influence of fuel cycle duration on nuclear unit performance, 15:347 (J;US)
Koppel, P.E., *See* Grohse, E.W., 15:731

Kordesch, K., European fuel cell research and development projects, 15:671 (BA;US)
Korobeinikov, V.G., Complex rocket - satellite experiment with plasma injection in magnetic anomaly region, 15:1898 (RA;BR)
Korosi, L., *See* Janoki, A., 15:1401
Koschny, D., *See* Okeefe, J.D., 15:1509
Koso, Selichi, Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
Kosslk, C.D., *See* Zimmerman, M.G., 15:1304
Kostochkin, O.I., *See* Merla, K., 15:968
Kotler, J.D., Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)
Kotov, A.A., *See* Andronenko, L.N., 15:1183
Kotte, R., Bragg curve ionization chamber, 15:1180 (RA;DD)
Test measurement with a Bragg ionization chamber at the Rossendorf tandem accelerator, 15:1181 (RA;DD)
Koussis, A.D., Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report, 15:1331 (R;US)
Kouts, H., [The safety of present and future nuclear power plants]: Foreign trip report, September 23, 1989–October 8, 1989, 15:1838 (R;US)
Kouvel, J.S., *See* Liu, Liwen, 15:875
See Said, M.R., 15:876
Kovarik, F.S., *See* Heller, J.P., 15:53
Kowel, S.T., *See* Mortazavi, M.A., 15:912
Koyama, Kazuhiko, *See* Sano, Kenichi, 15:546
Koyama, T., *See* Smolen, G.R., 15:119
Kozubal, A.J., *See* Howell, J.A., 15:1095
Kramer, S.K., Oxidation and explosive limits of low-rank coal, Volume 1: Final report, 15:20 (R;US)
Kramer, S.L., Study of collective effects in a low-emittance PEP lattice, 15:1141 (R;US)
Vacuum chamber thermal protection for the APS [Advanced Photon Source], 15:1109 (R;US)
Kramer, S.P., *See* Clark, R.E.H., 15:1709
Krane, R.J., *See* Conklin, J.C., 15:338
Kraus, H.G., *See* Herring, J.S., 15:1931
Krause, H.F., *See* Stolterfoht, N., 15:1785
Krause, S., Material degradation in a barium hydroxide latent heat storage pilot unit, 15:547 (R;FR)
Krause, W.J., Comparative analysis of tritium in water, 1987, 15:1344 (R;DE;In German)
Krawczyk, T.L., *See* Spriggs, G.D., 15:120, 15:457
Kraynik, A.M., Gelled propellant flow: Boundary layer theory for power-law fluids in a converging planar channel, 15:1058 (R;US)
Viscous effects in foam rheology, 15:56 (B;US)
Krebs, G.F., *See* Letessier-Selvon, A., 15:1787
Kreyenhagen, K.N., *See* Roddy, D.J., 15:1532
Krick, M.S., Maintenance neutron coincidence counter manual, 15:1167 (R;US)
Krieger, F.C., Heat-transfer optimization of a high-spin thermal battery, 15:575 (BA;US)
Krishnamurthy, H.R., *See* Sarker, S., 15:1866
Kroes, R.L., Development of new techniques for the characterization of crystals and their growth solutions: Center director's discretionary fund. Final report, 15:946 (R;US)
Kroma, J., *See* Knowles, R.N., 15:1132
Kroncke, K.E., *See* Rinard, P.M., 15:215
Kroncke, K.M., *See* Rinard, P.M., 15:151
Krueger, K., *See* Cleveland, J., 15:485
Kruer, W.L., *See* Drake, R.P., 15:1916
Kruk, J.W., *See* Gibbs, W.R., 15:1737
Krull, A.R., Summary of papers to be presented at the Eleventh computer security group conference, 15:1982 (R;US)
Kryter, R.C., ORNL Drawing Q-6240-2 (Rev.3) and Parts List Q-6240-5 (Engineering Materials), 15:1072 (E;US)
Kszos, L.A., Environmental Sciences Division Toxicology Laboratory standard operating procedures, 15:1443 (R;US)
Kuberka, K.A., *See* Lynch, D., 15:353
Kubic, W.L. Jr., Use of the linear variate method of Monte Carlo for estimating uncertainty in thermal-hydraulic codes, 15:480 (R;US)
Kuchynka, D.J., *See* Tsai, K.J., 15:555
Kuck, D.J., *See* Polychronopoulos, C.D., 15:2008
Kuczera, B. Hagen, S., LWR fuel rod bundle behavior under severe fuel damage conditions, 15:533 (J;US)
Kuefner, K., The charged particle transport module CIRCE as part of the KATACO code system, 15:1941 (R;DE)
Kuhlmann, S.E., Jets, W's, and Z's at $\sqrt{s}$ = 1.8 TeV, 15:1720 (R;US)
Kulander, K.C., *See* Perry, M.D., 15:1705
Kulik, D.M., *See* Bove, D.J., 15:624
Kulkarni, S.S., *See* Li, N.N., 15:700
Kulp, T.J., Enzyme-based fiber optic sensors, 15:1376 (BA;US)
Kulsrud, R., The case for a primordial galactic field, 15:1549 (RA;FR)
Kulsrud, R.M., *See* Cowley, S.C., 15:1885
Kumar, A., Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)
Kunk, M.J., *See* Hartung, J.B., 15:1486
Kunst, L., Altered regulation of lipid biosynthesis in a mutant of Arabidopsis deficient in chloroplast glycerol-3-phosphate acyltransferase activity, 15:1380 (J;US)
Kuntz, V.L.R., *See* Piazza, L.R., 15:1666
Kuo, S.P., *See* Whang, M.H., 15:1909
Kupperman, D.S., Application of neutron diffraction to the characterization of residual thermal strains in $YBa_2Cu_3O_{7-\delta}$/Ag, 15:849 (J;US)
Kurfess, J.D., *See* Share, G.H., 15:1149, 15:1150, 15:1151, 15:1152
Kuric, M.V., *See* Kebede, A., 15:851
Kurilla, R.G., Introduction to digital instrumentation and control techniques used in nuclear engineering, 15:463 (J;US)
Kurki-Suonio, T., Self-focusing of an optical beam in a plasma, 15:1917 (J;US)
Kurth, W.S., *See* Pickett, J.S., 15:1902, 15:1903, 15:1904
Kurtz, S.R., Current status of InAsSb strained-layer superlattice infrared detectors: Demonstration of a high detectivity, 10 μm photodiode, 15:255 (R;US)
See Leboeuf, C.M., 15:265
See Olson, J.M., 15:270
Kuryla, M.S., *See* MacMillan, H.F., 15:261
See Werthen, J.G., 15:288
Kurzynske, F.R., *See* Bartok, W., 15:312
Kustom, R., *See* Nicholls, G., 15:1110
Kutner, V.B., *See* Gikal, B.N., 15:1094
Kuwabara, M., On the atomic structure of the Nb/Al_2O_3 interface and the growth of Al_2O_3 particles, 15:804 (J;US)
Kwasny, R.J., Application of the d.c. potential method for continuous crack length measurement in CT samples of Incoloy 800 H at temperatures above 800^{0}C, 15:775 (R;DE;In German)
Kwei, G.H., *See* Shen, Z.X., 15:1873
Kwiatkowski, K., *See* Skulski, W., 15:1821
Kwok, K., *See* Chen, M., 15:1883
Kwok, W.K., *See* Welp, U., 15:864
Kwon, J.H., A survey of beam-combining technologies for laser space power transmission, 15:329 (R;US)
Kwong, N., Pigtailed single-mode diode lasers. Final report, 20 September 1988-30 April 1989, 15:1026 (R;US)
Kyser, E.A., *See* Duarte, D.S., 15:1000

L

LaBauve, R.J., *See* Young, P.G., 15:1776
Labus, T.L., *See* Secunde, R.R., 15:277
Ladle Ristow, M., *See* MacMillan, H.F., 15:261
See Werthen, J.G., 15:288
LadleRistow, M., *See* Kaminar, N.R., 15:291
Laermann, E., *See* Born, K.D., 15:1772
Lahm, C.E., *See* Pahl, R.G., 15:392
Lai, S., *See* Feng, X., 15:196
Lakeenkov, V.M., *See* Kalinin, A.A., 15:942
Laky, C., *See* Aunzo, Z., 15:297
Laleuf, M., True-personality-assisted self-awareness expert system, 15:416 (J;US)
Lallier, E., *See* Letessier-Selvon, A., 15:1787
Lambertson, G.R., *See* Goldberg, D.A., 15:1128
Lambropoulos, P., *See* Tang, X., 15:1704

Lamkin, S.L., *See* Wilson, J.W., 15:1740
Lampin, I., *See* Cadwallader, L.C., 15:1936
Lamppa, D.L., *See* Bunker, B.C., 15:1016
Lancaster, D.B., LEOPARD on a personal computer, 15:341 (J;US)
Perturbation, PCs, and the undergraduate, 15:406 (J;US)
Landa, M.E., *See* Rubio, M.C., 15:1398
Landau, R.H., *See* He, G., 15:1826
Landaud, G., *See* Letessier-Selvon, A., 15:1787
Landers, J.C., Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)
Landers, N.F., Uncertainties associated with the use of the KENO Monte Carlo criticality codes, 15:422 (R;US)
Landes, J.D., Nonlinear fracture mechanics. Volume 2. Elastic-plastic fracture, 15:802 (B;US)
Landis, G.A., Advances in thin-film solar cells for lightweight space photovoltaic power, 15:248 (R;US)
Solar power for the lunar night, 15:253 (R;US)
See Bailey, S.G., 15:251
Lane, N.F., *See* Hippler, R., 15:1714
Lang, H., *See* Klotz, D., 15:150
Langacker, P., Bounds on the mass of W_R and the W_L-W_R mixing angle ζ in general $SU(2)_L \times SU(2)_R \times U(1)$ models, 15:1754 (J;US)
Lange, R., Simulation of atmospheric dispersion of radioactivity from the Chernobyl accident, 15:1437 (R;US)
See Addis, R.P., 15:1286
Langer, G., *See* Behrens, U., 15:481
Langford, J.L., Reports management, 15:2011 (R;US)
Langhammer, F., *See* Born, K.D., 15:1772
Langhoff, S.R., *See* Bauschlicher, C.W. Jr., 15:944, 15:945
Langrock, E.J., Variant for on-line rapid extraction in nuclear-chemical experiments with crown ethers, 15:970 (RA;DD)
Langston, M.E., *See* Houlberg, L.M., 15:1299, 15:1300
See Saltzman, J., 15:193
Lanteri, V., *See* Heuer, A.H., 15:840
Lanzerotti, L.J., Hydromagnetic phenomena at the magnetopause and in the magnetosphere, 15:1632 (RA;BR)
Lappi, M., *See* Kilpelaeinen, H., 15:16
Larchier-Boulanger, J., Research activities in the field of human factors: Evaluation and prospects, 15:415 (J;US)
See Bienvenu, C., 15:414
Larese, J.Z., Layer-by-layer growth of solid argon films on graphite as studied by neutron diffraction, 15:913 (J;US)
Larkin, T.H., *See* Bennett, G.A., 15:1073
Larson, E.W., *See* Adams, M.L., 15:440
Larson, J.T., Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)
Larson, M.M., *See* Davis, M.V., 15:149
Larson, T.K., *See* Fink, R.K., 15:460
Lasinski, B.F., *See* Drake, R.P., 15:1916
Laska, A., Community and economic development, 15:590 (RA;US)
Community and economic development, 15:594 (RA;US)
Renewables, 15:603 (RA;US)
Laska, A.L., Renewable energy unit (Year 10), 15:595 (RA;US)
Laszewski, R.M., *See* Alarcon, R., 15:1792
See Papanicolas, C.N., 15:1205
Laughlin, D.L., Building Shielding Facility quarterly report, April, May, and June 1989, 15:499 (R;US)
See Hamrick, T.P., 15:477
Lavender, J.C., Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)
See Hostick, C.J., 15:207
Lawrence, R.D., Synthetic acceleration of integral-transport scattering iterations, 15:441 (J;US)
Laycak, J.F. Jr., Computer control for a particle beam accelerator, 15:1137 (J;US)
Le Goas, J.C., *See* Gozal, A., 15:377
Leaf, D.T., *See* Combs, R.T., 15:9
Leboeuf, C.M., Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells, 15:265 (BA;US)
Lebowitz, J.L., *See* Nielaba, P., 15:1856
Lechner, L., *See* Lindsey, G., 15:717
Leder, H.J., *See* Schmal, N., 15:396
Lee, A.D., Residential energy efficiency and fuel choice, 15:654 (R;US)
Lee, B., *See* McIntyre, P.M., 15:1114
Lee, I., Depolymerization of a model coal polymer, 15:23 (J;US)
Hole and antihole profiles in nonphotochemical hole-burned spectra, 15:957 (J;US)
Lee, J., *See* Wiebe, L.I., 15:963
Lee, J.H., *See* Kwon, J.H., 15:329
Lee, J.K., *See* Yoo, M.H., 15:765
Lee, K.D., Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah, 15:1229 (R;US)
Lee, R., *See* Hadder, G.R., 15:63, 15:78
Lee, R.L., *See* Leone, J.M. Jr., 15:1249
Lee, R.R., Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)
Team performance: Pitfalls and solutions, 15:407 (J;US)
Lee, W.C., Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Lee, W.W.L., *See* Isayama, Y., 15:156
Lee, Yun Ko, *See* Lee, K.D., 15:1229
Leeder, O., *See* Degering, D., 15:1545
Lehmann, W., *See* Gruenhagen, A., 15:1942
Leibler, S., *See* Anderson, D.M., 15:1382
Leicester, J., Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)
Lemaignan, C., *See* Durand, J.L., 15:433
Leme, N.M.P., Electron density decrease during geomagnetic storms observed by means of two different techniques, 15:1656 (RA;BR)
See Piazza, L.R., 15:1666
Leo, W.R., *See* Kumar, A., 15:1975
Leon, A.S., *See* Arguelles, M.G., 15:965
Leon, E., *See* Arguelles, M.G., 15:965
Leone, J.M. Jr., Numerical simulation of drainage flow in Brush Creek, Colorado, 15:1249 (J;US)
Leong, P.T., *See* Wu, M.K., 15:879
Leonida, A., Hydrogen/oxygen fuel cells with in-situ product water removal, 15:666 (BA;US)
See Baldwin, R., 15:661
Leskovar, B., Recent advances in detectors for single-photon counting, 15:1169 (R;US)
Lessner, P., *See* Sarangapani, S., 15:664
Lester, L.J., *See* Scheld, H.W., 15:647
Letessier-Selvon, A., Mass and transverse momentum dependence of the dielectron yield in *p*-Be collisions at 4.9 GeV, 15:1787 (J;US)
Leu, H.J., *See* Singh, J.P., 15:848
Leuer, J.A., *See* Bathke, C.G., 15:1901
See Peng, Y.K.M., 15:1888
Leung, K.N., *See* Walther, S.R., 15:1914
Leupold, H.A., Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures, 15:1017 (P;US)
Levi, M., Precision measurements of the SLC spectrometer magnets, 15:1131 (J;NL)
Levine, S.H., GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor, 15:479 (J;US)
See Hoffman, J.M., 15:1846
Lewiner, C., Mutual incidences of reactor operation and strategies for core refueling, 15:349 (J;US)
Lewins, J.D., Forward versus backward Kolmogorov equations with feedback, 15:442 (J;US)
Lewis, C.E., *See* Zarling, J.P., 15:1414, 15:1415
Lewis, C.R., *See* Werthen, J.G., 15:288
Lewis, H.R., Toroidal magnetic fields in terms of field-line invariants, 15:1943 (R;US)
Lewis, J.E., *See* Berg, R.M., 15:339
Lewis, R.N.A.H., Effect of fatty acyl chain length and structure on the lamellar gel to liquid-crystalline and lamellar to reversed hexagonal phase transitions of aqueous phosphatidylethanolamine dispersions, 15:1407 (J;US)
Li Zhaoyi, *See* Zhang Qingxuan, 15:919
Li, Che-Yu, *See* Ferro, P.D., 15:305

Li, H., Epitaxial growth of body-centered-tetragonal copper, 15:815 (J;US)
Li, N.N., Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)
Li, W., *See* Lynn, J.W., 15:860
Li, Y.S., *See* Li, H., 15:815
Lianos, D.P., *See* Jahan, M.S., 15:842
Liao, M.Z., *See* Balasubramanian, K., 15:1715
Liao, Y., *See* Shi, D., 15:862
Libbrecht, K.G., The excitation and damping of solar oscillations, 15:1550 (RA;FR)
Lichtenberg, D.B., Effects of diquarks and mesons on baryon magnetic moments, 15:1755 (J;US)
Lie, K.H., *See* Nilson, R.H., 15:1231
Lieberman, M.A., Model of plasma immersion ion implantation, 15:1861 (J;US)
Liengcharernsit, W., *See* Fingleton, D.J., 15:1317
Liewer, P.C., *See* Calalo, R.H., 15:1830
Lighton, J.R.B., Standard energy metabolism of a desert harvester ant, Pogonomyrmex rugosus: Effects of temperature, body mass, group size, and humidity, 15:1410 (J;US)
Ligou, J., *See* Kuefner, K., 15:1941
Likholetov, A.N., *See* Kalinin, A.A., 15:942
Lim, H.S., KOH concentration effect on the cycle life of nickel-hydrogen cells. 4: Results of failure analyse, 15:558 (RA;US)
Limbert, D.W.S., *See* Jones, P.D., 15:1239
Lin, C.S., Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)
Lin, Chinshun, Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)
Lin, H.L., *See* Yuan, H.J., 15:1824
Lin, R.P., Complete positive ion, electron, and ram negative ion measurements near Comet Halley (COPERNIC) plasma experiment for the European Giotto Mission. Final report, 15 April 1982-31 March 1988, 15:1595 (R;US)
Linak, W.P., Transient phenomena in rotary-kiln incineration, 15:736 (R;US)
Lindau, I., *See* Lindberg, P.A.P., 15:847, 15:857
See Shen, Z.X., 15:1873
See Wahi, A. K., 15:880
See Wells, B.O., 15:863
Lindberg, P.A.P., Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
See Shen, Z.X., 15:1873
See Wells, B.O., 15:863
Lindberg, S.E., Sampling and analysis protocols and project description for the Integrated Forest Study, 15:1262 (R;US)
Lindemann, L., Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring, 15:1158 (R;DE;In German)
Lindner, M., *See* Albright, C.H., 15:1743
Lindsey, G., Recycling grants in Illinois: A two year review. Final report, 15:717 (R;US)
Ling, K.M., *See* Hsiao Mingyuan, 15:1911
Linker, G., *See* Geerk, J., 15:826
Linley, K., *See* Fellows, M.E., 15:621
Linn, S., *See* Bengtsson, H., 15:1751
Lipkin, H.J., Getting maximum information from incomplete data on $B \rightarrow$ charmonium-K_S decays, 15:1721 (R;US)
The shell model approach: Key to hadron structure?, 15:1730 (R;US)
Lipman, P.W., Catastrophic volcanism, 15:1496 (RA;US)
Lippmann, M.J., *See* Aunzo, Z., 15:297
Lipton, R.J., Computational approaches to discovering semantics in molecular biology, 15:2006 (J;US)
List, F., *See* Micheelsen, B., 15:626
Littenberg, L.S., CP violation in $K_L \rightarrow \pi^0 e^+ e^-$, 15:1733 (R;US)
Little, R.C., *See* Young, P.G., 15:1776
Little, W.A., Gap-modulation infrared spectroscopy of high transition temperature superconductors, 15:1875 (J;US)
Liu, C.T., [Physical metallurgy and mechanical behavior of ordered intermetallics]: Foreign trip report, January 19, 1989–February 3, 1989, 15:789 (R;US)
Liu, D.D., *See* Kaminar, N.R., 15:291
See MacMillan, H.F., 15:261
Liu, J.Z., *See* Shen, D.S., 15:902
See Welp, U., 15:864
Liu, Liwen, Rotational magnetic processes in $YB_2Cu_3O_7$, 15:875 (R;US)
Livi, S.H.B., Energy cancellation and emission in solar atmosphere, 15:1563 (RA;BR;In Portuguese)
Livingston, B.L., Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)
Livingston, R.C., Ionospheric scintillation studies. Final report, October 1984-September 1987, 15:1616 (R;US)
Llacer, J., Stopping rules, Bayesian reconstructions and sieves, 15:1214 (R;US)
Lloyd, R.C., Criticality experiments with mixed plutonium-uranium nitrate solution at plutonium fraction of 0.5, 0.4, and 0.2 in slab and cylindrical geometry, 15:1003 (J;US)
Lo, E.H., Focal heavy charged particle irradiation of the mammalian cortex: Temporal pattern of changes followed by magnetic resonance imaging and positron emission tomography, 15:1435 (R;US)
Loach, P.A., Comparison of structural subunits of the core light-harvesting complexes of photosynthetic bacteria, 15:241 (R;US)
Lober, R., *See* Mazumder, J., 15:754
Lockhart, J.L, Underwater measuring gage, 15:1343 (P;US)
Lockhart, T.G., *See* Calalo, R.H., 15:1830
Loehman, R.E., *See* Ho, P., 15:845
Loer, S., Test results on a CEBAF/Cornell prototype superconducting cavity fabricated by TRW, 15:1130 (BA;US)
Logan, R.R., *See* Zarling, J.P., 15:1414, 15:1415
Logsdon, G.M., *See* Kszos, L.A., 15:1443
Loh, E.Y., Lanczos diagonalizations of the 1-D Peierls-Hubbard model, 15:1852 (R;US)
Loh, E.Y. Jr., *See* Gammel, J.T., 15:1872
Loken, M.C., *See* Osnes, J.D., 15:142
Lomon, E.L., *See* Blunden, P.G., 15:1827
London, R.A., Wavelength choice for soft x-ray laser holography of biological samples, 15:1219 (J;US)
Long, E.R. Jr., Absorbed dose thresholds and absorbed dose rate limitations for studies of electron radiation effects on polyetherimides, 15:882 (R;US)
Long, M.B., Simultaneous multipoint measurements of density gradients and temperature in a flame: Final report, August 1, 1985–July 31, 1987, 15:972 (R;US)
Long, R.L., *See* Briant, V.S., 15:409
See Fiedler, P.B., 15:345
Long, S.A.T., *See* Long, E.R. Jr., 15:882
Long, W.R., *See* Swanson, T.D., 15:1056
Longhurst, G.R., Permeation of tritium through HYLIFE-II heat exchanger tubes, 15:1929 (R;US)
Uranium storage bed accident hazards evaluation, 15:1940 (R;US)
Longrigg, P., Analytical chemical diagnostic testing of environmental exposed thin-film PV modules, 15:259 (BA;US)
Longua, K.J., *See* Tracy, D.B., 15:113
Lonneman, W.A., *See* Seila, R.L., 15:1268
Loo, B.H., *See* Wu, M.K., 15:879
Looney, B.B., *See* Haselow, J.S., 15:1305
Loper, D.E., Catastrophic volcanism as a cause of shocked features found at the K/T boundary and in cryptoexplosion structures, 15:1497 (RA;US)
Lopiano, D., *See* Garnett, R., 15:1729
Lorenz, J.C., *See* Finley, S.J., 15:87
Lorenz, P.B., Guidelines help select reservoirs for $NaHCO_3$ EOR, 15:60 (J;US)
Lott, J.A., Investigation of charge storage in InAs/AlAsSb quantum well capacitors, 15:1077 (J;US)
Louie, S.G., *See* Wang, X.W., 15:867
Louro, A.A., Equatorial F region electrodynamics, 15:1657 (RA;BR)
Loveland, W.D., Oregon State University nuclear chemistry progress report, August 1, 1988–August 1, 1989, 15:1794 (R;US)
Lovely, R.G., *See* Secunde, R.R., 15:277

Lovett, G.M., *See* Lindberg, S.E., 15:1262
Lowenstein, D.I., *See* Chen, M., 15:1883
Loyd, D.H., *See* Schneider, D., 15:1711
Lu, C.Y., *See* Bents, D.J., 15:274
Lu, E.T., The evolution of energetic particles and the emitted radiation in solar flares. Ph.D. Thesis, 15:1584 (R;US)
Lubeck, O.M., *See* Burns, P.J., 15:1988
Lubensky, T.C., *See* Golubovic, L., 15:908
Luby, J.C., *See* Wen, T., 15:1322
Lucas, C.A., *See* Robert, H.M.B., 15:1557
Luckhardt, S.C., *See* Chen, M., 15:1883
Ludewigt, B.A., *See* Renner, T.R., 15:1208
Luft, W., *See* Wallace, W., 15:258
Lukas, H., *See* Booser, E.R., 15:303
Luna, J., *See* Frederking, T.H.K., 15:988
Luna, R.E., Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code, 15:208 (J;US)
Lundby, W., *See* Bove, D.J., 15:624
Lundin, W.E., *See* Sime, D.G., 15:1601
Lundquist, J.T., *See* Anderman, M., 15:571
Luthardt, G., Treatment of tritium from liquid and solid wastes for the purpose of recycling (input to an enrichment plant). Final report, 15:157 (R;DE;In German)
Lutz, H.O., *See* Hippler, R., 15:1714
Lux, C.R., Applications of probabilistic risk assessment to criticality safety at the Savannah River Site, 15:507 (R;US)
Luxmoore, R.J., [Field-scale water and solute flux in soils]: Foreign trip report, September 21–30, 1989, 15:1416 (R;US)
Luzi, A., *See* Buehlmann, E.T., 15:304
Lyczkowski, R.W., Computation of dynamics and erosion for small tube arrays in fluidized beds, 15:1088 (BA;US)
See Bouillard, J.X., 15:1086
See Chang, S.L., 15:1087
Lynch, D., Application of an industrial gas supply system to a hydrogen water chemistry installation, 15:353 (J;US)
Lynch, V.E., *See* Lyon, J.F., 15:1013
Lynen, U., *See* Pochodzalla, J., 15:1801
Lynn, J.W., Pressure dependence of the Cu magnetic order in $RBa_2Cu_3O_{6+x}$, 15:860 (J;US)
Lyon, J.F., Compact torsatron reactors, 15:1013 (J;US)
Lyon, R.E., *See* Holland, D.F., 15:1939
See McKenzie-Carter, M.A., 15:1282
Lyons, J.R., *See* Calalo, R.H., 15:1830
Lyons, L.A., Development and application of a new material for control of asiatic clams, 15:410 (J;US)
Lyras, A., *See* Tang, X., 15:1704
Lysaght, P.S., *See* Fowler, M.M., 15:1207
Lysek, M.J., *See* Pettersen, M.S., 15:914
Lyzenga, G.A., *See* Calalo, R.H., 15:1830

M

Ma, E., Radiative quark and lepton masses in a left-right gauge model, 15:1746 (J;US)
Ma, M., *See* Sarker, S., 15:1866
Maag, R., *See* Levine, S.H., 15:479
MacDonald, J.C., *See* Carlson, R.D., 15:1839
MacDougall, J.D., Seawater strontium isotopes at the Cretaceous-Tertiary boundary, 15:1498 (RA;US)
Macedo, P.B., *See* Feng, X., 15:196
MacFarlane, R.E., *See* Young, P.G., 15:1776
Machado, M.A.E., Solar interplanetary coupling, 15:1555 (RA;BR)
Machalett, F., *See* Muehle, R., 15:1699, 15:1700
Mack, G., *See* Zucconi, L., 15:1998
Mackinnon, B., *See* Petravick, D., 15:1135
MacKinnon, B., *See* Berg, D., 15:1140
Macleod, K., *See* Ward, P.D., 15:1534
MacLeod, N., Inducement of heterochronic variation in a species of planktic foraminifera by a Late Eocene impact event, 15:1499 (RA;US)
MacMillan, H.F., 28% efficient GaAs concentrator solar cells, 15:261 (BA;US)
Multijunction III-V solar cells: Recent and projected results, 15:257 (BA;US)
See Kaminar, N.R., 15:291
Maddalena, D.J., Simple method for the preparation of difficult ^{99m}Tc complexes using surface adsorbed stannous ions, 15:962 (RA;AR)
Structure-activity studies on ^{99m}Tc phenolic aminocarboxyllic acid hepatobiliary agente, 15:1400 (RA;AR)
See Awaluddin, A., 15:1396
Maddux, E.P., *See* Duarte, D.S., 15:1000
Madeheim, H., *See* Hippler, R., 15:1714
Madison, L., Absolute multilayer characterization at high spatial resolution via real-time soft x-ray imaging, 15:1907 (R;US)
Madland, D.G., *See* Young, P.G., 15:1776
Maedler, P., *See* Biedermann, M., 15:1809, 15:1810
Maerker, R.E., The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry, 15:352 (J;US)
Maerten, H., Experimental arrangement for the measurement of correlations between fission products and neutrons, 15:1197 (RA;DD)
Fortran code for the calculation of 'realistic' distributions of neutrons produced in hydrogen-isotope reactions, 15:1831 (RA;DD)
Gradually evaporated foils for aberration correction of fission fragment time-of-flight in a direction-sensitive arrangement, 15:1196 (RA;DD)
Mahajan, S., *See* Zabot, S., 15:281
Mahan, J.E., Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report, 15:883 (R;US)
Mahara, Yasunori, Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)
Mahmood, S., Optimal sensor configuration and survivable processing with correlated noise. Final report, 15:1227 (R;US)
Mahrenholtz, O., Calculation of steady and transient torsional vibrations of marine diesels of different system configurations and geometry, 15:741 (R;DE;In German)
Malkischer, S., *See* Rivera, E.S., 15:1399
Mallinson, R.G., *See* Lee, I., 15:23
Maltrud, H.R., *See* Caffrey, A.J., 15:1884
Mancini, A.C., *See* Noto, M.G., 15:964
Mandeville, J., *See* Papanicolas, C.N., 15:1205
Mandl, R., *See* Umminger, K., 15:354
Manfrass, P., Converter multiwire proportional chamber (MWPC) in the multi-step avalanche mode, 15:1184 (RA;DD)
First investigations with a stationary positron camera, 15:1405 (RA;DD)
Manko, D.J., *See* Srinivasan, S., 15:659
Manneschmidt, J.F., *See* Koger, K.H., 15:466
Mannock, D.A., *See* Lewis, R.N.A.H., 15:1407
Manns, J., Development of the software of the data taking system SOS for the SAPHIR experiment, 15:1981 (R;DE;In German)
Manohar, A.V., *See* Chivukula, R.S., 15:1760
Manouklan, M., *See* Sarangapani, S., 15:664
Manousakis, E., Paired-magnon analysis of quantum antiferromagnets, 15:1864 (J;US)
Manshadi, F., *See* Calalo, R.H., 15:1830
Mansour, M.M., On the scattering function of simple fluids in finite systems, 15:1741 (J;US)
Manzano, J.R., *See* Rios, V.H., 15:1685
Manzini, Alberto, *See* Noto, M.G., 15:966, 15:1432
Manzo, M.A., Small scale bipolar nickel-hydrogen testing, 15:581 (BA;US)
See Brewer, J.C., 15:557
Marazas, B., The search for absorption of 1 keV X-rays by the Small Magellanic Cloud, 15:1590 (R;US)
Marchon, B., *See* Ogletree, D.F., 15:781
Marciano, W., Renormalization-group-improved unitarity bounds on the Higgs-boson and top-quark masses, 15:1759 (J;US)
Marcinkowski, A., Neutron emission cross sections on ^{184}W at 11.5 and 26 MeV and the neutron-nucleus scattering mechanism, 15:1793 (J;NL)
Marcus, P.M., *See* Li, H., 15:815
Marek, J.C, *See* Doherty, J.P., 15:199
Mareschal, M., *See* Mansour, M.M., 15:1741

Margetson, J., *See* Groves, A., 15:979
Margolis, S.V., Trace element and isotope geochemistry of Cretaceous-Tertiary boundary sediments: identification of extra-terrestrial and volcanic components, 15:1500 (RA;US)
Marianer, S., *See* Gammel, J.T., 15:1872
Markovich, P., *See* Den Hartog, P.K., 15:1090
Marlow, K.W., *See* Share, G.H., 15:1149
Marques, A., Muon induced fission and fission track dating, 15:921 (RA;BR)
Marr, T.G., *See* Lipton, R.J., 15:2006
Marsaglia, G., Numerical solution of some classical differential-difference equations, 15:2003 (J;US)
Marsaglia, J.C.W., *See* Marsaglia, G., 15:2003
Marsh, B.D., The delineation and interpretation of the earth's gravity field. Annual progress report, 1 June 1988-31 May 1989, 15:1585 (R;US)
Marsh, K.V., *See* Buddemeier, R.W., 15:171
Marshall, A., *See* Nellis, W.J., 15:800
Marshall, J.S., *See* Iannello, V., 15:980
Marsi, J.A., Reactor coolant seal testing under station blackout conditions, 15:529 (J;US)
Martelli, F.G., *See* Boretti, A.A., 15:971
Martin, D.J., Technology module for shoreline wave energy conversion in the UK, 15:299 (R;GB)
Martin, E., *See* MacDougall, J.D., 15:1498
Martin, E.R., *See* Spriggs, G.D., 15:457
Martin, G.D., *See* Kamperschroer, J.H., 15:1970
Martin, I.M., Secondary cosmic ray measurements in the stratosphere near Campinas, Brazil, and South Atlantic, Africa, 15:1672 (RA;BR)
See Van, N.A.B., 15:1673, 15:1674
Martin, M.R., *See* Briggs, J.B., 15:490
Martin, R.E., *See* Spriggs, G.D., 15:120
Martin, S.M., *See* Jackson, S.M., 15:1543
Martinez-Val, J.M., Reactivity calculations of the Chernobyl accident, 15:530 (J;US)
Maruyama, A., *See* Shen, D.S., 15:902
Masarotti, A., *See* Griest, K., 15:1581
Mascarenhas, A., *See* Tsuo, Y.S., 15:900
Mashburn, D.N., *See* Geohegan, D.B., 15:1870
Masin, J.G., *See* Furlong, M.W., 15:2
Mason, S.I., *See* Scheld, H.W., 15:647
Massonnet, L., *See* Boniface, J., 15:776
Masters, F.J., *See* Maynard, R.L., 15:1037
Masuda, Masahiro, *See* Ida, Toshio, 15:467
Masuya, Goro, Calculation of scramjet performance, 15:695 (R;JP;In Japanese)
Mathew, M.K., High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 1. DNA size standards and the effect of agarose and temperature, 15:1385 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 2. Effect of pulse time and electric field strength and implications for models of the separation process, 15:1386 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 4. Influence of DNA topology, 15:1388 (J;US)
Matos, J.E., *See* Brown, K.R., 15:475
Matson, R., *See* Longrigg, P., 15:259
Matsubara, Koji, *See* Ono, Takao, 15:323
Matsuda, H.T., *See* Yamaura, M., 15:925
Matsuda, H.T.M., *See* Alem, M.C., 15:926
Matsuda, M., *See* Thurston, T.R., 15:856
Matsuda, Yoshiharu, Effects of the organic electrolyte solution on rechargeability of Li electrode, 15:565 (BA;US)
Matsumoto, Hiroyuki, *See* Jojo, Kazumasa, 15:301
Matsumoto, J., *See* Donley, S., 15:578
Matsumoto, T., *See* Funabashi, H., 15:118
Matsumura, Hirohisa, *See* Fukuda, Hideo, 15:238
Matsunaga, Yukuo, *See* Sano, Kenichi, 15:546
Matsushita, T., *See* Oversluizen, T., 15:1105
Mattisson, S., *See* Skjellum, A., 15:1999
Mattson, J., Magnetotransport studies of epitaxial Cr thin films, 15:764 (R;US)
Mattson, J.E., *See* Brodsky, M.B., 15:762
Matz, W., *See* Reichel, P., 15:1176
Maurer, W., *See* Gruenhagen, A., 15:1942
Mauritsch, H.J., *See* Preisinger, A., 15:1512
Maurrasse, F.J.M.R., Step-wise extinctions at the Cretaceous-Tertiary boundary and their climatic implications, 15:1501 (RA;US)
Maxwell, E.L., *See* Hulstrom, R.L., 15:239
Mayberry, J.L, Municipal waste processing apparatus, 15:1081 (P;US)
Maynard, R.L., Long-pulse operation of a Nd:glass laser, 15:1037 (BA;US)
Maziasz, P.J., Microstructural evolution of martensitic steels during fast neutron iradiation, 15:1920 (R;US)
Mazor, A., Model for a decorated twin boundary in ferroelastic martensites, 15:1867 (J;US)
Mazumder, J., Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)
McBride, L.E., *See* Caudill, H.H., 15:917
McCallum, R.W., *See* Ullman, J.E., 15:841
McCampbell, C.B., Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB), 15:1223 (R;US)
McCandless, P.C., *See* Mitchell, A.C., 15:1604
McCarron, E.M., *See* Chakraborty, A., 15:865
McCarthy, J.F., Mobility of colloidal particles in the subsurface: Chemistry and hydrology of colloid-aquifer interactions: International series of interactive seminars summary report, 15:1468 (R;US)
McCarthy, J.M., *See* Garner, F.A., 15:798
McCartney, K., *See* Loper, D.E., 15:1497
McCarty, J.G., Chemical and catalytic activation of methane by metal oxide surfaces. Annual report, September 1, 1987-August 31, 1988, 15:227 (R;US)
McClaflin, R.S., How to successfully move data between a personnel mainframe HRIS and the REGISTRAR, 15:1996 (R;US)
McClellan, E., *See* Lyons, L.A., 15:410
McClelland, M.A., Time-dependent free convection in liquid metals, 15:1059 (R;US)
McCliment, E.R., *See* Trost, L.H., 15:1728
McCloskey, D.J., Accident progression analysis of past severe accidents, 15:503 (R;US)
McConnell, E.E., Toxicology and carcinogenesis studies of two pentachlorophenol technical-grade mixtures (CAS No. 87-86-5) in B6C3F1 mice (feed studies). Technical report series, 15:1458 (R;US)
McConnell, J.W., Results of field testing of waste forms using lysimeters, 15:148 (R;US)
See Dickens, J.K., 15:1206
McCormick, J.J., Publications resulting from research supported in whole or in part by this grant: Progress report, September 1987–August 1988, 15:1441 (R;US)
Mccoy, J.E., *See* Noble, S.T., 15:1689
McCracken, M.C., Quantifying the link between change in radiative balance and atmospheric temperature, 15:1280 (R;US)
McDaniel, J.C., *See* Chang, D.B., 15:1041
McDonald, J.C., *See* Hertel, N.E., 15:1844
McDonell, W.R., Economic analysis of projected high-level waste immobilization operations at the Savannah River Plant, 15:137 (RA;US)
McElhaney, R.N., *See* Lewis, R.N.A.H., 15:1407
McElhaney, S.A., *See* Chiles, M.M., 15:1160
McElroy, D.L., Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory, 15:1318 (R;US)
Mcelroy, J., *See* Baldwin, R., 15:661
McElroy, W.N., Dosimetry-adjusted reactor physics parameters for pressure vessel neutron exposure assessment, 15:351 (J;US)
McGhee, D., Status of magnet power supply development for the APS [Advanced Photon Source] storage ring, 15:1144 (R;US)
McGlynn, J.F., Foam and gel decontamination techniques, 15:967 (R;US)

McGuire, M.J., *See* Balachandran, U., 15:822
McHargue, C.J., [Surface engineering by high energy beams]: Foreign trip report, September 23–October 6, 1989, 15:1853 (R;US)
[Surface modification of metals by ion beams]: Foreign trip report, August 24, 1988–October 11, 1988, 15:833 (R;US)
McIlwain, M.E., *See* Dugan, P.R., 15:8
McInnes, G., *See* Eggleston, H.S., 15:1263
McIntosh, L., *See* Debus, R.J., 15:1384
McIntyre, P.M., Gigatron, a new technology for microwave power devices, 15:1114 (R;US)
Mckechnie, T.N., *See* Holmes, R.R., 15:757
McKenney, J.E., Characterization and development report for the SA3259: An operational amplifier, 15:1074 (R;US)
McKenzie-Carter, M.A., Methodology for assessing the radiological consequences of radioactive releases from the CIT [Compact Ignition Tokamak] facility at PPPL [Princeton Plasma Physics Laboratory], 15:1282 (R;US)
Mckissock, B.I., Space nuclear reactor shields for manned and unmanned applications, 15:400 (R;US)
McLaren, D.J., Mass killings and detection of impacts, 15:1502 (RA;US)
McLeod, D., *See* Geesaman, D.F., 15:1134
McMillan, H.F., *See* Werthen, J.G., 15:288
McMillen, R.T., *See* Doran, J.C., 15:1246
McNair, G.W., *See* Schneider, K.J., 15:204
McNulty, I., Soft x-ray microscope using Fourier transform holography, 15:1107 (R;US)
McPheeters, C.C., *See* Myles, K.M., 15:658
McSorley, J.A., *See* Linak, W.P., 15:736
McWhorter, A.L., Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
Meacham, J.A., SAND DEVIL: A digital video link for telemetry applications, 15:1216 (R;US)
Mead, C.A., *See* Hancock, G.C., 15:952
Meadows, J.W., A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
Medeiros, R.T., *See* Bonelli, E., 15:1649
Medrano, R.A., Ionospheric absorption cosmic noise observations in Antartic, 15:1658 (RA;BR)
Medrano-Balboa, R.A., Sunrise in the ionospheric D-Layer and the total atmospheric ozone content, 15:1659 (RA;BR)
Medrono, R.A., *See* Muralikrishna, P., 15:1661
Medvick, P.A., *See* Aine, C.J., 15:1402
Meeker, B.E., *See* Wiebe, L.I., 15:963
Meeks, S.A., *See* Seila, R.L., 15:1268
Mehra, R.K., *See* Mahmood, S., 15:1227
Mei, Z., *See* Chan, J.W., 15:780
Meier, D.L., Antimony-doped dendritic web silicon solar cells, 15:260 (BA;US)
Meier, G.H., *See* Perkins, R.A., 15:752
Meijaer, A., Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)
Meister, A., *See* Eckstein, P., 15:1195
Melanson, H.L., *See* Geesaman, D.F., 15:1134
Melton, J.G., Energy ratings for metal oxide varistors under repetitively pulsed operation, 15:1948 (R;US)
See Boenig, H.J., 15:1960
Mendes Junior, O., *See* Pinto Junior, O., 15:1567
Mendez, A., *See* Gunion, J.F., 15:1752
Mendoza, B., Solar wind streams, magnetospheric substorms and El Nino, 15:1564 (RA;BR)
See Perez-Enriquez, R., 15:1562, 15:1681
Mengers, T.F., Sequential rat blood boron concentration measurements method using CR-39 SSNTDs, 15:1406 (J;US)
Mercer, A.C., Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough], 15:706 (R;GB)
Mercer, J.R., *See* Wiebe, L.I., 15:963
Merkle, J.G., *See* Landes, J.D., 15:802
Merla, K., Determination of the areal density of the Pu-239 fission-foils, 15:968 (RA;DD)
Determination of the inhomogeneity of U-238 fission-foils by Rutherford-backscattering (RBS) measurements, 15:969 (RA;DD)
See Herbach, C.M., 15:1191, 15:1192, 15:1778
Merlo, C.A., Separation, fractionation concentration and drying of food products: Addendum report, April 1, 1988–April 30, 1989, 15:701 (R;US)
Merriam, R., Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)
Merrigan, M., *See* Trujillo, V., 15:656
Merrill, B.J., Safety implications of a graphite oxidation accident in the compact ignition tokamak device, 15:1933 (R;US)
Merryfield, W.J., Nonlinear studies of solar gravity modes driven by nuclear burning of He3 in the core, 15:1551 (RA;FR)
Mestnik, S.A.C., Separation of ^{99}Mo from ^{132}Te using thiourea as complexing agent. Application to the separation of ^{99}Mo from the fission products, 15:960 (R;BR)
Meyer, A.P., Proton exchange membrane fuel cells, 15:669 (BA;US)
Meyer, C.T., A combustion/deposition entrained reactor for high temperature/pressure studies of coal and coal minerals, 15:35 (B;US)
Meyer, H.M. III, *See* Wagener, T.J., 15:854
Meyer, J., *See* Mon, G., 15:901
Meyer, J.D., Materials research with ion beams. Simulation and analysis, 15:939 (R;DE;In German)
Meyer, O., *See* Geerk, J., 15:826
Meyer, P.E., *See* Takeuchi, K., 15:455
Meyer, P.J., *See* McClelland, M.A., 15:1059
Meylan, D., *See* Boniface, J., 15:776
Miaou, Shaw-Pin, *See* Hu, P.S., 15:1466
Micell, P.F., *See* Jorgensen, J.D., 15:1869
Michael, D.G., *See* Geesaman, D.F., 15:1134
Michalski, T., *See* Loach, P.A., 15:241
Michaut, B., Nickel electroplating of steam generator tubes (kiss sleeving process), 15:376 (J;US)
Michaelsen, B., Department of Energy Technology Annual Progress Report, 1 January-31 December 1988, 15:626 (R;DK)
Michel, H.V., *See* Alvarez, W., 15:1474
See Asaro, F., 15:1475
Michels, N., *See* Mulderink, H., 15:1163
Michie, R.B., *See* Raymond, T.D., 15:1039
Mickael, M., *See* Gardner, R.P., 15:1220
Micklich, B.J., Discharge of ^{41}Ar from a neutron activation analysis facility, 15:545 (J;US)
Mihalczo, J.T., Californium-252-source-driven noise analysis measurements for six interacting safe bottles of aqueous uranyl nitrate, 15:1007 (J;US)
Mihalisin, T., *See* Kebede, A., 15:851
Mikellides, P., *See* York, T.M., 15:1002
Mikuni, A., *See* Oversluizen, T., 15:1105
Milek, B., Fortran programmes for the calculation of single-particle quantities in heavy-ion collisions in a two-center basis, 15:1701 (RA;DD)
Miley, D.V., *See* Debsikdar, J.C., 15:825
Miley, G.H., *See* Varadarajan, V., 15:1921
Milgram, M.S., Does a point lie inside a polygon, 15:446 (J;US)
Miller, C.W., Implications of the Chernobyl accident for US reactors, 15:526 (J;US)
Miller, D., *See* Fox, J., 15:1255
Miller, D.A., Modularization concepts for advanced nuclear power plants, 15:419 (J;US)
Miller, E.L., On the dynamic response of pressure transmission lines in the research of helium-charged free piston Stirling engines, 15:742 (R;US)
Miller, J.E., *See* Vozzo, S.F., 15:1444
Miller, J.R., *See* Summers, L.T., 15:998
Miller, K.L., *See* Ahrenkiel, R.K., 15:907
Miller, L., Multi-mission Ni-H2 battery cell for the 1990's, 15:559 (RA;US)
Miller, M.K., [Atom probe field-ion microscopy research on silicon carbide whiskers and evaluate the position sensitive atom probe]: Foreign trip report, September 28, 1988–October 9, 1988, 15:1174 (R;US)
Miller, P.D., *See* Stolterfoht, N., 15:1785
Miller, R.A., *See* Perkins, R.A., 15:752

Miller, R.D., Waste-to-energy, 15:629 (RA;US)
Miller, R.J.D., *See* Zhou, X., 15:911
Miller, R.L., The ARIES-I high-field-tokamak reactor: Design-point determination and parametric studies, 15:1958 (R;US)
Miller, S.F., *See* Reeme, T.L., 15:1327
Miller, S.S, Method of inducing surface ensembles on a metal catalyst, 15:15 (P;US)
Miller, W.H., *See* Yang, W., 15:954
Millot, J.P., Introduction of advanced pressurized water reactors in France, 15:368 (J;US)
Mills, B., *See* Hirooka, Y., 15:910
Milora, S.L., *See* Gouge, M.J., 15:1919
Milstein, R.L., Calvin 28 cryptoexplosive disturbance, Cass County, Michigan: Evidence for impact origin, 15:1503 (RA;US)
Milton, H.T., *See* Caudill, H.H., 15:917
Min, T.K., *See* Dick, J.E., 15:534
Minato, Akihiko, Transient analysis method for two-dimensional discharge flow using a two-fluid model, 15:451 (J;US)
Minck, R., *See* Chang, R.R., 15:561
Mine, Hisaichi, *See* Fujisawa, Kazuya, 15:245
Minehart, R.C., *See* Smith, L.C., 15:1783
Miner, W.H. Jr., *See* Wiley, J.C., 15:1893
Mines, G.L., *See* Bliem, C.J., 15:296
Mings, W.J., The contribution of spent-fuel shipping cask residual contamination to the transportation source term, 15:130 (J;US)
See Ottinger, C.A., 15:129
Minkin, J.A., *See* Chen, J.R., 15:1212
Mirabito, L., *See* Colas, P., 15:1739
Misra, A.K., Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report, 15:881 (R;US)
Mitchell, A.C., Equation of state data of shock compressed liquid CO_2 and synthetic Uranus, 15:1604 (R;US)
Mitchell, A.L., Characterization of oil and gas reservoir heterogeneity: Second quarterly report, July 15–October 15, 1989, 15:47 (R;US)
Mitchell, A.W., *See* Pei, S.Y., 15:821
Mitchell, D.G., *See* Eastman, T.E., 15:1541
Mitchell, J.A., *See* Guberman, S.L., 15:1694
Mitta, A.E.A., Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986, 15:961 (R;AR)
See Arguelles, M.G., 15:965
Mitzi, D.B., *See* Lindberg, P.A.P., 15:847, 15:857
See Wells, B.O., 15:863
Miura, Y., Mineralogical and geochemical anomalous data of the K-T boundary samples, 15:1504 (RA;US)
Miyaji, Shigeki, *See* Hachisu, Izumi, 15:1583
Moinester, M., *See* Smith, L.C., 15:1783
Molchanov, O.A., VLF wave phenomena inside the plasmasphere and at the upper ionosphere, 15:1633 (RA;BR)
Moltz, D.M., Heavy ions as probes of nuclei far from stability, 15:1780 (R;US)
Molvik, A.W., *See* Futch, A.H., 15:1971
Mon, G., Electrochemical and galvanic corrosion effects in thin-film photovoltaic modules, 15:901 (BA;US)
Moncur, N.K., *See* Maynard, R.L., 15:1037
See Stanley, J.G., 15:1038
Mondok, E.P., *See* Rhodes, D.W., 15:136
Montanari, A., *See* Asaro, F., 15:1475
Montano, D., The topology of moduli space and quantum field theory, 15:1769 (J;NL)
Montelongo, S., CAMAC control of diverse data acquisition instrumentation, 15:470 (J;US)
Moore, C., *See* Dorries, T., 15:1138
See Pordes, R., 15:1133
Moore, C.D., *See* Huth, J., 15:1204
Moore, E.F., *See* Ahmad, I., 15:1799
Moore, J., The Eastern Environmental Radiation Facility's participation in interlaboratory and intralaboratory comparisons of environmental sample analyses, 1981–1986, 15:1840 (R;US)
Moore, J.B., Application of Advanced Material for Turbomachinery and Rocket Propulsion, 15:756 (R;US)
Moore, J.R., *See* Nave, S.E., 15:768
Moran, B., *See* Hoover, W.G., 15:1067
Moran, B.W., Safeguards and security recommendations for the OCRWM [Office of Civilian Radioactive Waste Management] Federal Waste Management System, 15:213 (R;US)
Morari, M., *See* Skjellum, A., 15:1999
Morgan, W.J., Flood basalts and mass extinctions, 15:1505 (RA;US)
Morgenstern, V.M., *See* Gloeckler, O., 15:518
Mori, Kazuo, *See* Yokote, Mitsuhiro, 15:359
Mori, T., Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR, 15:492 (R;DE)
Moriarty, J.A., *See* Holmes, N.C., 15:806
Morioka, Shinichi, A comparison between criticality analyses for unreflected systems by Monte Carlo codes MCNP and MONK6A, 15:1006 (J;US)
Morita, Masayuki, *See* Matsuda, Yoshiharu, 15:565
Moriwaki, M., *See* Shanfield, Z., 15:1210
Morris, J.W. Jr., The metallurgical determinants of toughness as cryogenic temperature, 15:779 (R;US)
The science of thermomechanical processing, 15:778 (R;US)
See Chan, J.W., 15:780
Morrison, P.J., *See* Kurki-Suonio, T., 15:1917
Morrison, W.S., *See* Corbett, R.A., 15:176
Morrow, P.E., Responses of susceptible subpopulations to nitrogen dioxide. Research report, June 1983-January 1988, 15:1461 (R;US)
Morse, E.C., *See* Walther, S.R., 15:1914
Morss, L.R., *See* Ahmad, I., 15:1799
Mortazavi, M.A., Harmonic generation with ultrashort pulses using nonlinear poled polymeric thin films, 15:912 (J;US)
Mortensen, A., *See* Koczak, M.J., 15:890
Moser, H., *See* Klotz, D., 15:150
Moszkowski, S.A., *See* Yuan, H.J., 15:1824
Mottershead, C.T., *See* Howell, J.A., 15:1095
Moura, M.S.M., *See* Leme, N.M.P., 15:1656
See Piazza, L.R., 15:1666
Mowat, J.R., *See* Schneider, D., 15:1711
Mowbary, A.S., *See* Ahmad, I., 15:1799
Moya, M.M., Generalization in backpropagation networks: An empirical study using image data, 15:1995 (R;US)
Muddukrishna, S.N., *See* Joshua, A.V, 15:1397
Muehl, P., *See* Langrock, E.J., 15:970
Muehle, R., Basic characteristics of an Au-Si-liquid metal ion source, 15:1699 (RA;DD)
Mass spectrometry of liquid metal ion sources, 15:1700 (RA;DD)
Muenchausen, R.E., *See* Peterson, E.J., 15:877
Muesch, H., Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
Muhs, J.D., Fiber-optic sensors for composite cure analysis and lifetime nondestructive evaluation, 15:871 (R;US)
Mukai, M., *See* Yokote, Mitsuhiro, 15:359
Mulderink, H., Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD), 15:1163 (R;US)
Muller, D., *See* Trost, L.H., 15:1728
Muller, R.C., Inspection of contaminated hot cell ductwork, 15:991 (R;US)
Mulpuru, S.R., Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample, 15:519 (J;US)
Mundschenk, H., *See* Krause, W.J., 15:1344
Munshi, P., *See* Arora, R., 15:454
Munson, F.H., *See* Den Hartog, P.K., 15:1090
Murakami, T., *See* Yamada, K., 15:855
Murali, A.V., Deccan volcanism and K-T boundary signatures, 15:1506 (RA;US)
See Sharpton, V.L., 15:1523
Muralikrishma, P., Plasma bubble characteristics as observed by a rocket-borne langmuir probe and a high frequency capacitance probe, 15:1660 (RA;BR)
Muralikrishna, P., Distributed currents in the equatorial ionosphere over South American and Indian sub-continents: a comparison, 15:1661 (RA;BR)
See Kantor, I.J., 15:1897
See Medrano, R.A., 15:1658
See Sobral, J.H.A., 15:1669

Murata, Shigeto, *See* Minato, Akihiko, 15:451
Murday, M., *See* Gundlach, E.R., 15:1326
Murdick, S.A., Reactor operator: Training for the job while earning college credit, 15:404 (J;US)
Murphy, J., *See* West, J.T., 15:445
Murphy, O.J., *See* Appleby, A.J., 15:556
Musiol, G., *See* Herbach, C.M., 15:1190, 15:1191, 15:1192, 15:1778, 15:1782
Musolf, M.J., *See* Haxton, W.C., 15:1815
Mussino, V., *See* Storini, M., 15:1556
Mustafa, M.G., Quantum-mechanical approaches to continuum angular distributions, 15:1881 (R;US)
Myer, F.E., *See* Yang, Wen K., 15:1368
Myer, G.H., *See* Kebede, A., 15:851
Myers, D.R., *See* Ashby, C.I.H., 15:909
See Vawter, G.A., 15:1040
Myers, J., *See* Scheps, R., 15:1019, 15:1020
Myles, K.M., Monolithic solid oxide fuel cell development, 15:658 (RA;US)
Mynatt, J.O., *See* Cottrell, W.D., 15:1308, 15:1309, 15:1310

N

Nagao, Taiji, *See* Koso, Seiichi, 15:319
See Takenaka, Kiyoshi, 15:317
Nagele, J.W., Calculation of ground states for many-fermion systems, 15:1882 (J;US)
Nakagawa, Kamiichiro, *See* Mahara, Yasunori, 15:1350
Nakai, R., *See* Koger, K.H., 15:466
Nakamura, Takashi, *See* Sasaki, Misao, 15:1594
Nakamura, Y., *See* Sobral, J.H.A., 15:1669
Nakura, Saburo, *See* Yokote, Mitsuhiro, 15:359
Naiette, T., *See* Baldwin, R., 15:661
Nam, C.H., *See* Hershkowitz, N., 15:1217
Namazov, C.A., *See* Korobeinikov, V.G., 15:1898
Namgung, W., *See* Lichtenberg, D.B., 15:1755
Namkoong, D., Flight experiment of thermal energy storage, 15:276 (R;US)
Nananara, Toshiya, Simulation model for automatic generation control, 15:321 (R;JP;In Japanese)
Nanjundiah, C., *See* Dominey, L.A., 15:568
Naruse, Y., *See* Bartlit, J.R., 15:1952
See Enoeda, M., 15:1950
See Ide, T., 15:1945
Nash, J., *See* Levi, M., 15:1131
Nave, S.E., Magnetic behavior of curium and americium-curium alloys, 15:768 (R;US)
Navon, I., *See* Smith, L.C., 15:1783
Nazarov, M.A., *See* Kolesnikov, E.M., 15:1494
Nealy, J.E., *See* Wilson, J.W., 15:1740
Neff, D.E., Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)
Neff, W.D., The accumulation and pooling of drainage flows in a large basin, 15:1248 (J;US)
See Doran, J.C., 15:1246
Negishi, Tadashi, Accumulation of alveolar macrophages in golden hamster lung after long-term exposure to coal fly-ash particles, 15:37 (R;JP;In Japanese)
Neill, P.H., Identification of the heteroatom containing compounds in the benzene/methanol extracts of the Argonne Premium Coal Samples, 15:17 (R;US)
See Winans, R.E., 15:19
Neill, R., Technical evaluation of WIPP by the New Mexico environmental evaluation group, 15:185 (J;US)
Nelson, G.H., Studies of plasma performance and transport in the advanced toroidal facility (ATF), 15:1889 (R;US)
Nelson, R.M. Jr., *See* Smolik, G.R., 15:1938
Nellis, W.J., Micron-thin Nb films recovered from Mbar shock pressures, 15:800 (R;US)
See Holmes, N.C., 15:806
See Mitchell, A.C., 15:1604
Nelson, A., *See* Mon, G., 15:901
Nelson, A.J., *See* Longrigg, P., 15:259
Nelson, B.A., *See* Ribe, F.L., 15:1892
Nelson, D.B., *See* Decker, J.F., 15:2005
Nelson, P.A., Advanced high-temperature batteries, 15:562 (RA;US)
Nelson, T.P., *See* Hummel, K.E., 15:720
Nelson, W.R., Development of an accident management expert system for containment assessment, 15:508 (BA;US)
Identification of the operating crew's information needs for accident management, 15:511 (J;US)
Nesmeynov, V.I., *See* Korobeinikov, V.G., 15:1898
Neubert, W., *See* Andronenko, L.N., 15:1183
See Iljin, A.I., 15:1198
See Maerten, H., 15:1196, 15:1197
Neuenschwander, G.G., *See* Elliott, D.C., 15:254
Neuhauser, K.S., *See* Luna, R.E., 15:208
Neuhoff, J.W., *See* Micklich, B.J., 15:545
Neumann, D.A., *See* Jorgensen, J.D., 15:1869
Newman, L., Achieving excellence on shift through teamwork, 15:417 (J;US)
Newsam, J.M., *See* Pei, S.Y., 15:821
Newsom, C.R., *See* Trost, L.H., 15:1728
Ng, E.K., Hazardous-waste technical-assistance survey, Carswell AFB, Texas. Final report, 16-27 May 1988, 15:730 (R;US)
Ng, K., Higgs-boson decay into two gluinos, 15:1757 (J;US)
Nguyen, D.C., Blue-green (450-nm) upconversion Tm^{3+}:YLF laser, 15:1045 (J;US)
Nguyen, T., *See* Mahrenholtz, O., 15:741
Nicholls, G., Status report on the radio frequency accelerating system of the APS [Advanced Photon Source] at Argonne, 15:1110 (R;US)
Nichols, D.J., Plant microfossil record of the terminal Cretaceous event in the western United States and Canada, 15:1507 (RA;US)
Nichols, R.L., *See* Haselow, J.S., 15:1305
Nicinski, T., *See* Berg, D., 15:1140
Nicklow, R.M., *See* Fernandez-Baca, J.A., 15:1849
Nicodemus, D.O., *See* Allen, R.E., 15:380
Nielaba, P., Behavior of a quantum particle in contact with a classical heat bath, 15:1856 (J;US)
Niemann, R.C., *See* Boroski, W.N., 15:1122
See Gonczy, J.D., 15:1123, 15:1124
Nierman, W.C., Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)
Nifenecker, H., *See* Pinston, J.A., 15:221
Nigon, M., *See* Millot, J.P., 15:368
Nikbakht, A., *See* Houlberg, L.M., 15:1299, 15:1300
Nikityuk, N.M., Some questions of using the algebraic coding theory for construction of special-purpose processors in high energy physics spectrometers, 15:1165 (R;SU)
Nikolaeva, T.D., *See* Volkovskaya, E.I., 15:941
Nilson, R.H., Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)
Nishimura, Izumi, *See* Negishi, Tadashi, 15:37
Nishioka, Hiromasa, *See* Ida, Toshio, 15:467
Nitschke, J.M., *See* Moltz, D.M., 15:1780
Nixon, J.M., *See* Den Hartog, P.K., 15:1090
Noble, S.T., HF sideband generation in the ionosphere, 15:1689 (J;US)
Nobrega, A.W. da, Specification and characteristics of ion selective electrode for uranium (VI), 15:923 (R;BR;In Portuguese)
Uranium (VI) determination by Radiometric Stripping Analysis (X ray), 15:922 (R;BR;In Portuguese)
Nodean, W.C., *See* Danofsky, R.A., 15:405
Noh, T.W., *See* Kaplan, S.G., 15:858
Nopper, H., *See* Umminger, K., 15:354
Norberg-King, T.J., *See* Weber, C.I., 15:1446
Nordemann, D.J.R., Radon measurements in the Amazon region (GTE-ABLE2B, April-May, 1987), 15:1283 (RA;BR)
Nordmann, R., Rotordynamic coefficients for labyrinth seals calculated by means of a finite difference technique, 15:989 (RA;US)
Nose, Junta, *See* Fujisawa, Kazuya, 15:245
Noskowski, E., *See* Herz, R.K., 15:1032
Noto, M.G., Biodistribution and dosimetric evaluation of ^{186}Re hydroxy ethylen diphosphate., 15:1432 (RA;AR;In Spanish)

Preparation and quality control of ^{186}Re compounds., 15:964 (RA;AR;In Spanish)
Preparation and quality control of fibrinogen ^{99m}Tc, 15:966 (RA;AR;In Spanish)
Notz, K.J., Characteristics of spent fuel and high-level waste, 15:192 (J;US)
Nuckels, J.H., Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)
Nunez, J., *See* Llacer, J., 15:1214
Nunno, T., Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Nuttall, H.E., Filtration of polydispersed colloids, 15:180 (B;US)
Nwokoye, A., *See* Ozoemena, P.C., 15:1663
Nygren, R.E., *See* Hirooka, Y., 15:910
Nyman, M.A., *See* Renner, T.R., 15:1208
Nystrom-Rosander, C., *See* Spielberg, H., 15:1417

O

O'Brien, M.H., *See* Merrill, B.J., 15:1933
O'Connell, R.A., Northeast regional biomass energy program: Progress report, July 1989–September 1989, 15:231 (R;US)
O'Connor, C., NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988, 15:932 (R;US)
O'Connor, T.E., *See* Kamperschroer, J.H., 15:1970
Oakley, M.T., *See* Aine, C.J., 15:1402
Oates, D.E., Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)
Oberman, C.R., *See* Susskind, S.M., 15:1696
Obike, O.J., *See* Ozoemena, P.C., 15:1663
Oblozinsky, P., Absence of parity effects in preequilibrium γ emission, 15:1800 (R;DE)
Ocal, C., *See* Ogletree, D.F., 15:781
Ochoa, E., Position, rotation, and intensity invariant recognizing method, 15:1080 (P;US)
Ocoma, E.C., Seismic qualification of safety class components in existing non-reactor nuclear facilites at Hanford Site, 15:115 (R;US)
Oconnell, S., *See* Wise, S.W., 15:1537
Odar, F., *See* Chambers, R., 15:522
Officer, C.B., Cretaceous-Tertiary findings, paradigms and problems, 15:1508 (RA;US)
Ogletree, D.F., STM study of the structure of sulfur ($2\sqrt{3} \times 2\sqrt{3}$)R30° overlayer on rhenium (0001), 15:781 (R;US)
Ogorzalek-Loo, R., *See* Janik, G.R., 15:1706
Oh, B.Y., High-rho$_T$ single photon and jet production at Fermilab energies, 15:1767 (BA;US)
Oh, J.E., Molecular beam epitaxial growth of high-quality InSb on InP and GaAs substrates, 15:885 (R;US)
Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates, 15:886 (R;US)
Ohashi, Y., *See* Garnett, R., 15:1729
Ohi, J., *See* Wallace, W., 15:258
Oka, T., *See* Funabashi, H., 15:118
Okeefe, J.D., Environmental effects of large impacts on the earth; relation to extinction mechanisms, 15:1509 (RA;US)
Okubo, Susumu, Nijenhuis tensor and integrable models, 15:1764 (R;US)
Okumoto, Yoshiharu, *See* Jojo, Kazumasa, 15:301
Okuno, K., *See* Bartlit, J.R., 15:1952
See Enoeda, M., 15:1950
See Ide, T., 15:1945
Olander, D.R., *See* Sherman, D.F., 15:838
Olchowy, G.A., A simplified representation for the thermal conductivity of fluids in the critical region, 15:949 (J;US)
Oleynik, G., *See* Berg, D., 15:1140
See Bernett, M., 15:1139
See Constanta-Fanourakis, P., 15:1136
See Pordes, R., 15:1133
Oliger, J., Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988, 15:981 (R;US)
Olin, R.C., Quality-assurance procedures: Method 28A measurement of air-to-fuel ratio and minimum burn rate for wood-fired appliances, 15:1267 (R;US)
Olive, K.A., *See* Ryu, Dongsu, 15:1589
Oliveira, J.C.T., *See* Kordesch, K., 15:671
Olness, F., *See* Gunion, J.F., 15:1752
Olson, E.A.J., *See* Koppe, R.H., 15:347
Olson, E.C., Permo-Triassic vertebrate extinctions: A program, 15:1510 (RA;US)
Olson, J.M., A 21.8% $GaInP_2$/GaAs tandem solar cell, 15:270 (BA;US)
See Leboeuf, C.M., 15:265
Olson, R.E., *See* Schneider, D., 15:1711
Ono, Takao, Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
Onwemichili, C.A., *See* Ozoema, P.C., 15:1662
Onwumechili, C.A., *See* Ozoemena, P.C., 15:1664
Oraevsky, V.N., *See* Korobeinikov, V.G., 15:1398
Orechwa, Y., *See* Cerdan, J.L., 15:394
Oreg, J., *See* Bar-Shalom, A., 15:1915
Orgill, M.M., *See* Barr, S., 15:1287
See Whiteman, C.D., 15:1245, 15:1247
Orlando, J.J., *See* Rosso, M.J. Jr., 15:668
Oro, J., Chemical evolution: A solar system perspective, 15:1588 (RA;US)
Orr, F.M. Jr., Reservoir characterization for the CO_2 enhanced oil recovery process: Final report, 15:52 (R;US)
Orr, R.S., *See* Johnson, F.T., 15:372
Orth, C.J., *See* Wolbach, W.S., 15:1538
Ortlepp, H.G., Preamplifier for silicon particle detectors, 15:1188 (RA;DD)
Shaping amplifier for Bragg curve spectroscopy, 15:1182 (RA;DD)
Timing with fast particle detectors, 15:1186 (RA;DD)
See Kotte, R., 15:1181
See Seidel, W., 15:1185
Osakwe, L.O., *See* Ozoemena, P.C., 15:1663
Osborne-Lee, I.W., *See* Ferrada, J.J., 15:1983
Osella, A.M., Effects of electrical inhomogenetties on short period geomagnetic variations, 15:1644 (RA;BR)
Oset, E., Exchange currents in double charge exchange, 15:1738 (R;US)
See Garcia-Recio, C., 15:1823
Osnes, J.D., Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0, 15:142 (R;US)
Osumi, Takashi, *See* Mahara, Yasunori, 15:1350
Otaduy, P., *See* Baird, B., 15:2001
Otavka, J.G., *See* Gonczy, J.D., 15:1124
Ott, E., *See* Bleher, S., 15:1744
Ott, K.C., *See* Peterson, E.J., 15:877
See Shen, Z.X., 15:1873
Ottenstein, L., *See* Swanson, T.D., 15:1056
Ottesen, C.W., *See* Meacham, J.A., 15:1216
Ottinger, C.A., Long-term materials testing of transportable storage cask containment and basket materials, 15:129 (J;US)
Otyaola, J., *See* Bravo, S., 15:1650
Ougouag, A.M., *See* Stubbins, J.F., 15:453
Ousley, G.W., *See* Triolo, J.J., 15:784
Oversluizen, T., Performance of a directly water-cooled silicon crystal for use in high-power synchrotron radiation applications, 15:1105 (R;US)
Owen, M.R., Cathodoluminescence of shocked quartz at the Cretaceous-Tertiary boundary, 15:1511 (RA;US)
Owens, J.G., *See* Lindberg, S.E., 15:1262
Owsenek, L.W., Experience-based classical RCM at Ginna, 15:367 (J;US)
Owu, K., *See* Ozoemena, P.C., 15:1663
Owyoung, A, *See* Esherick, P., 15:1047
Oyama, Seiichi, Survey on synthesis technologies of methanol as an alternative fuel, 15:228 (R;JP;In Japanese)
Ozawa,Yasushi, *See* Oyama, Seiichi, 15:228

Ozoema, P.C., Mode of variation of the electrojet width with current intensity during the solstices, 15:1662 (RA;BR)
Ozoemena, P.C., Morphology of EEJ: - Possible horizontal and vertical profiles from satellites and rockets data of equatorial electrojet, 15:1664 (RA;BR)
Overhead configurations of Equatorial Electrojet (EEJ) at different seasons, 15:1663 (RA;BR)

P

Paciotti, M.A., *See* Caffrey, A.J., 15:1884
Padamsee, H., *See* Loer, S., 15:1130
Padua, D.A., *See* Polychronopoulos, C.D., 15:2008
Paetz genannt Schieck, H, *See* Eversheim, P.D., 15:1125
Pagen, V.A., *See* Breckenridge, N.J., 15:379
Pahl, R.G., Irradiation performance of metallic fuels, 15:392 (R;US)
Pakvasa, S., *See* Cudell, J.R., 15:1753
Palmer, D.A., Molal dissociation quotients of water in sodium trifluoromethanesulfonate solutions to high temperatures, 15:948 (J;US)
Palmer, R.B., [Advanced acceleration]: Foreign trip report, August 16–26, 1989, 15:1120 (R;US)
Palmer, S., *See* Nunno, T., 15:723
Pang, S.K., Doping dependence of minority carrier lifetime in Ga-doped silicon, 15:904 (BA;US)
Pang, Yaoqi, *See* McIntyre, P.M., 15:1114
Pantell, R.H., *See* Kephart, J.O., 15:1862
Papanicolas, C.N., Out-of-plane spectrometry: Why and how, 15:1205 (J;NL)
Pardo, P.M.R., *See* Rao, K.R., 15:1670
Pardo, R.C., Operating experience with the Argonne PIIECR ion source system, 15:1112 (R;US)
See Den Hartog, P.K., 15:1090
Parekh, P.P., *See* Murali, A.V., 15:1506
Parisi, M., *See* Storini, M., 15:1556
Park, B., Laser droplet heating: fast and slow heating regimes, 15:1250 (J;US)
Park, H., *See* Kephart, J.O., 15:1862
Park, O.Y., *See* Chung, T.J., 15:973
Parker, R.R., *See* Chen, M., 15:1883
Parkes-Loach, P.S., *See* Loach, P.A., 15:241
Parkhurst, B.R., *See* Warren-Hicks, W., 15:1353
Parkinson, T.F., *See* Jaeger, C.A., 15:364
Parkinson, W.J., *See* Peterson, E.J., 15:877
Parks, C.V., Demonstration of criticality safety for the modified TN-REG and TN-BRP transport/storage casks, 15:986 (R;US)
Evaluation of shielding analysis methods for spent fuel casks, 15:125 (R;US)
See Greene, N.M., 15:141
Parks, G.T., *See* Lewins, J.D., 15:442
Parks, J.W., *See* Carswell, R.W., 15:363
Parris, K.M., *See* Sebold, F.D., 15:652
Parrish, D.K., *See* Osnes, J.D., 15:142
Partain, L.D., *See* Kaminar, N.R., 15:291
Pasciak, J.E., *See* Bramble, J.H., 15:2002
Passell, L., *See* Larese, J.Z., 15:913
Pasupathi, V., *See* Mings, W.J., 15:130
Patterson, J.E., *See* Calalo, R.H., 15:1830
Pau, J.C., *See* Finkel, J.M., 15:25
Paula, E. de, *See* Sobral, J.H.A., 15:1668
Paula, E.R. de, Ionospheric responses over the brazilian territory to the magnetic storm of february 7-10,1986, 15:1665 (RA;BR)
Pausch, G., *See* Herbach, C.M., 15:1190, 15:1191, 15:1192, 15:1778, 15:1782, 15:1832
Pawley, G.S., *See* Baillie, C.F., 15:1878
Pearlstein, S., Medium energy charged particle data for evaluation, 15:1774 (R;US)
Pearson, M.D., Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989, 15:684 (R;US)
Pecchio, M., *See* Teixeira, W., 15:1470
Peddicord, K.L., Collaboration in nuclear engineering education between France and the United States: Participation of French students at Texas A & M University, 15:434 (J;US)
See Durand, J.L., 15:433
Peden, C.H.F., *See* Zavadil, K.R., 15:805
Pedersen, L.D., *See* Merlo, C.A., 15:701
Pederson, R.A., *See* Spriggs, G.D., 15:120, 15:457
Pegg, I.L., *See* Feng, X., 15:196
Pei, S.Y., Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system, 15:821 (R;US)
Pei, Shiyou, *See* Dabrowski, B., 15:823
Peire, J., *See* Castro, M., 15:287
Pellow, M.D., *See* Mulpuru, S.R., 15:519
Peltier, W.H., *See* Weber, C.I., 15:1446
Pence, R., *See* Ramirez, T.L., 15:1224
Peng, J.L., Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds, 15:853 (J;US)
Peng, Y.K.M., MHD equilibrium and stability considerations for high-aspect-ratio ARIES-I tokamak reactors, 15:1888 (R;US)
Penkala, J.L., *See* Levine, S.H., 15:479
Pennington, A.J., *See* Hall, B.E., 15:531
Penny, R.K., Design method for pressure vessels containing randomly flawed welds. Technical report, 15:992 (R;ZA)
Pepmiller, P.L., *See* Stolterfoht, N., 15:1785
Perch-Nielsen, K., *See* Tredous, M., 15:1531
Percus, J.K., Collective modes in Ising lattices, 15:1858 (J;US)
Pereira, E.B., *See* Nordemann, D.J.R., 15:1283
Pereira, J.C.F., Finite difference methods in recirculating flows, 15:1050 (RA;FR)
Perera, R.C.C., *See* Thomas, M.M., 15:1215
Perez, R., *See* Merla, K., 15:968
Perez-Enriquez, R., Solar activity and EL nino, 15:1562 (RA;BR)
Solar activity and EL Nino: the auroral connection, 15:1681 (RA;BR)
See Mendoza, B., 15:1564
Perez-Peraza, J., Perspectives of electron-capture and alternative methods for dianosis of particle sources and acceleration processes, 15:1896 (RA;BR)
Perkins, L.J., *See* Haney, S.W., 15:1908
Perkins, R.A., Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989, 15:752 (R;US)
Perkins, W.C., The human factor in first-year operations, 15:116 (J;US)
Perla, H.F., *See* Flanagan, G.F., 15:484
Permann, P.J., *See* Jackson, S.M., 15:1543
Perret-Gallix, D., *See* Boniface, J., 15:776
See Gonzalez-Mestres, L., 15:1168, 15:1726
Perry, M.D., Resonantly enhanced above-threshold ionization of helium, 15:1705 (J;US)
Perry, R.T., *See* Wilson, W.B., 15:1806
See Young, P.G., 15:1776
Persily, A., *See* Dols, W.S., 15:692
Persson, E., *See* Rasmussen, R.W., 15:102
Peru, D.A., *See* Lorenz, P.B., 15:60
Peruzzi, I., *See* Ford, W.T., 15:1727
Peshkin, M., *See* Freedman, M.S., 15:1779
Peter, F.M., *See* Wilson, E.O., 15:1392
Peters, P.N., *See* Wu, M.K., 15:879
Peters, R., *See* Fingleton, D.J., 15:1317
Peters, R.L., Executive overview of World Wildlife's conference on consequences of the greenhouse effect for biological diversity: Final project report, 15:1253 (R;US)
Peters, R.W., *See* Cadena, F., 15:1254
Petersen, G., Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea, 15:1258 (R;DE)
Petersen, R.D., In-drum vitrification of transuranium waste sludge using microwave energy, 15:169 (R;US)
Peterson, E.J., Development of inherently safe and environmentally acceptable intelligent processing technologies for HTS materials, 15:877 (R;US)
Peterson, E.W., *See* Nilson, R.H., 15:1231
Peterson, L., *See* Skjellum, A., 15:1999
Peterson, M.B., *See* Jahanmir, S., 15:1064
Peterson, R.W., *See* Hoess, J.A., 15:132
Petrasek, D.W., Fiber reinforced superalloys for rocket engines, 15:759 (RA;US)
Petravick, D., The PAN-DA data acquisition system, 15:1135 (J;US)

See Constanta-Fanourakis, P., 15:1136
See Geesaman, D.F., 15:1134
Petravick, D.L., Remote procedure execution software for distributed systems, 15:2010 (J;US)
Petrie, L.M., *See* Landers, N.F., 15:422
Pettersen, M.S., Melting in multilayer adsorbed films, 15:914 (J;US)
Pettifor, D.G., [Modeling and experimental efforts on ordered intermetallic alloys]: Foreign trip report, May 21–June 5, 1988, 15:787 (R;US)
Pfaff Junior, R.F., Simultaneous rocket and radar measurements of plasma instabilities in the Equatorial electrojet, 15:1634 (RA;BR)
Pham, M., *See* Baldwin, R., 15:661
Phantumvanit, D., *See* Fingleton, D.J., 15:1317
Phillips, J., *See* Chang, O.K., 15:569
Phillips, M.H., *See* Lo, E.H., 15:1435
Phillips, W.R., *See* Ahmad, I., 15:1799
Pi, H., *See* Durand, L., 15:1750
Piascik, T.G., *See* Howe, T.M., 15:344
Piasetsky, E., *See* Smith, L.C., 15:1783
Piazza, C.R., *See* Bailey, S.A., 15:1172
Piazza, L.R., VLF transmissions phenomena observed in the Antarctic peninsula, 15:1666 (RA;BR)
See Costa, A.M. da, 15:1651
See Leme, N.M.P., 15:1656
See Medrano-Balboa, R.A., 15:1659
Piccolo, M., *See* Ford, W.T., 15:1727
Pickett, J.S., Plasma diagnostics package. Volume 2: Spacelab 2 section. Part B: Thesis projects. Final science report, 15:1902 (R;US)
Plasma diagnostics package. Volume 1: OSS-1 section. Final science report, 15:1903 (R;US)
Plasma diagnostics package. Volume 2: Spacelab 2 section, part A. Final science report, 15:1904 (R;US)
Picklesimer, A., *See* Chinn, C.R., 15:1820
Picorel, R., *See* Seibert, M., 15:1378
Pierre-Aubry, M., *See* Jansa, L.F., 15:1492
Piet, S.J., *See* Brereton, S.J., 15:1932
See Cadwallader, L.C., 15:1930
See Smolik, G.R., 15:1938
Pigford, T.H., *See* Isayama, Y., 15:156
Pillay, K.K.S., Safeguards issues relevant to geologic disposal of spent nuclear fuels, 15:152 (R;US)
Pin, F.G., *See* Goldstein, M., 15:1990
Pines, D., Neutron stars: A cosmic hadron physics laboratory, 15:1582 (R;US)
Pinston, J.A., High energy gamma-ray production in nuclear reactions, 15:221 (R;FR)
Pinto Junior, O., Effects of corotation electric field on the dynamic of energetic particles in an asymetric planetary magnetic field, 15:1567 (RA;BR)
Mesospheric ozone depletion due to electron precipitation at the South Atlantic Magnetic Anomaly during geomagnetic storms, 15:1684 (RA;BR)
See Pinto, J.R.C.A., 15:1683
Pinto, I.R.C.A., *See* Pinto Junior, O., 15:1567
Pinto, J.R.C.A., Stratospheric electric fields due to electrified convective clouds, 15:1683 (RA;BR)
Piper, B.F., Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)
Pitts, J.H., Starlight: A stationary inertial-confinement-fusion reactor with nonvaporizing walls, 15:1972 (R;US)
Pizzica, P.A., An improved steam generator model for the SASSYS code, 15:393 (R;US)
Pjerov, S., *See* Schuchman, J.C., 15:1106
Planchat, J.P., Reserve lithium-thionyl chloride battery for missile applications, 15:574 (BA;US)
Planer, N., *See* Rasmussen, R.W., 15:102
Plante, E., *See* Interrante, C., 15:160
Plaskon, L.A., *See* Miller, C.W., 15:526
Plassmann, E.A., *See* Spriggs, G.D., 15:120, 15:457
Ploszajczak, M., *See* Drozdz, S., 15:1879
Plys, M.G., Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document, 15:523 (J;US)
See Hawley, J.T., 15:489
Pochodzalla, J., Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
Poeppel, R.B., *See* Balachandran, U., 15:822
See Singh, J.P., 15:848
Poinsot, T.J., Direct simulation of compressible reacting flows, 15:976 (RA;US)
Pointon, T.D., Charge exchange effects in ion diodes, 15:1707 (J;US)
Pois, H., *See* Ng, K., 15:1757
Pojer, P.M., *See* Maddalena, D.J., 15:962
Pokhunkov, A.A., *See* Korobeinikov, V.G., 15:1898
Polewczak, J., *See* Greenberg, W., 15:1747, 15:1835
Poljak, A., *See* Lo, E.H., 15:1435
Polk, P.J., *See* Krick, M.S., 15:1167
Pollat, L.L., Design and drafting document control procedures for CPRF/ZTH experiment, 15:1946 (R;US)
Pollock, C.R., *See* Sievers, A.J., 15:1018
Polychronopoulos, C.D., Utilizing multidimensional loop parallelism on large-scale parallel processor systems, 15:2008 (J;US)
Polzer, W.L., Experiences of fitting isotherms to data from batch sorption experiments for radionuclides on tuffs, 15:154 (R;US)
Pong, L.T., *See* Young, M.F., 15:510
Popovic, M.B., *See* McIntyre, P.M., 15:1114
Porch, W.M., *See* Addis, R.P., 15:1286
Pordes, R., Software for FASTBUS and Motorola 68K based readout controllers for data acquisition, 15:1133 (J;US)
See Dorries, T., 15:1138
Porter, D.L., *See* Pahl, R.G., 15:392
Poskanzer, A.M., *See* Ritter, H.G., 15:1807
Pospichal, J., *See* Wise, S.W., 15:1537
Pospieszcyk, A., *See* Hirooka, Y., 15:910
Post, R.M., *See* Lyons, L.A., 15:410
Powers, A.G., *See* Schuster, J.R., 15:990
Prakash, J., Electrocatalysts for oxygen electrodes in fuel cells and water electrolyzers for space applications, 15:662 (RA;US)
Prawirosoehardjo, S., *See* Dick, J.E., 15:534
Preisinger, A., Bio-, Magneto- and event-stratigraphy across the K-T boundary, 15:1512 (RA;US)
Preiss, J., *See* Heath, R.L., 15:240
Prendergast, J.T., Opportunities for industry to improve its competitive position, 15:639 (RA;US)
Presa, J.L., *See* Castro, M., 15:287
Prettyman, T.H., *See* Gardner, R.P., 15:1220
Prewo, K., *See* Koczak, M.J., 15:890
Preyer, N.W., *See* Thurston, T.R., 15:856
Priatko, G.J, Method and apparatus for optical communication by frequency modulation, 15:1046 (P;US)
Price, D.L., Structure and dynamics of disordered systems, 15:1829 (R;US)
Price, K.R., *See* Eberhardt, L.E., 15:166
Prince, K.R., Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation, 15:1332 (R;US)
Prince, P.P., *See* Ballard, E.O., 15:1947
Principotta, F.T., *See* Stern, R.D., 15:311
Prinn, R.G., Biospheric traumas caused by large impacts and predicted relics in the sedimentary record, 15:1513 (RA;US)
Probst, I., *See* Maerten, H., 15:1196
Prodell, A.G., [Superconducting magnet test facilities at CERN [European Organization for Nuclear Research] and modifications to the cryogenic system for the AGS Experiment 840]: Foreign trip report, September 21, 1989–September 24, 1989, 15:1117 (R;US)
[Testing superconducting magnets for the HERA project]: Foreign trip report, September 16–September 24, 1989, 15:1118 (R;US)
Pryor, D.V., *See* Burns, P.J., 15:1988
Przybylowicz, J.W., *See* Dobosy, R.J., 15:1240
Puphal, K.W., *See* Lee, K.D., 15:1229
Purcell, J.A., *See* Duarte, D.S., 15:1000
Pursley, W.A., *See* Vozzo, S.F., 15:1444
Pyrlik, J., *See* Ford, W.T., 15:1727

Q

Qi, N., *See* Ford, W.T., 15:1727
Qualls, A.L., Development of an expert system for signal validation, 15:420 (J;US)
Quentmeyer, R.J., Thrust chamber thermal barrier coating techniques, 15:758 (RA;US)
Quigley, D., *See* Dugan, P.R., 15:8
Quigley, D.R., Chemical comminution and deashing of low rank coals, 15:21 (R;US)
Quimby, D.C., *See* Elliott, C.J., 15:1030
Quinlan, M.A., *See* McCarty, J.G., 15:227
Quinn, J., *See* Li, H., 15:815
Quinn, J.W., Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)
Quinn, P.J., *See* Hernquist, L., 15:1608
Quintao, D.A., *See* Martin, I.M., 15:1672
Quiros, M., *See* del Aguila, F., 15:1745

R

Ra, Y., *See* Hirooka, Y., 15:910
Rabiller, Graciela, *See* Noto, M.G., 15:966
Radicella, S., *See* Ezquer, R.G., 15:1652
Radousky, H.B., *See* Peng, J.L., 15:853
Ragan, G.E., *See* Mihalczo, J.T., 15:1007
Raghaven, R., Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Rahaelian, L., *See* Boparai, A., 15:24
Rahman, A., *See* Schneider, M., 15:899
Raimondo, E., *See* Jahnke, S., 15:374
Rainwater, J.C., Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus, 15:1061 (J;US)
Ralston, J.P., Model dependence of astrophysical lower bounds on the neutrino mass, 15:1612 (J;US)
Ram, A.K., Kinetic ray tracing in toroidal geometry with application to mode-converted ion-Bernstein waves, 15:1906 (R;US)
Raman, S., Comment on "Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei", 15:1795 (J;US)
Ramanujam, G., *See* Koussis, A.D., 15:1331
Ramirez, T.L., Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989, 15:1224 (R;US)
Rampino, M.R., Climatic changes resulting from mass extinctions at the K-T boundary (and other bio-events), 15:1515 (RA;US)
Flood basalt eruptions, comet showers, and mass extinction events, 15:1514 (RA;US)
Ranken, W., *See* Trujillo, V., 15:656
Rankin, W.N., *See* McGlynn, J.F., 15:967
Ransom, V.H., *See* Fink, R.K., 15:460
Rao, K.R., Geomagnetic storm effects on radiowave absorption in the geomagnetic anomaly region, 15:1670 (RA;BR)
Rao, K.S., *See* Dobosy, R.J., 15:1240
Rapaport, J., *See* Marcinkowski, A., 15:1793
Rarback, H., *See* McNulty, I., 15:1107
Raridon, R.J., *See* Whealton, J.H., 15:1924
Rasmussen, D.A., *See* Stewart, K.A., 15:1976
Rasmussen, R.W., Evaluation of auxiliary-power subsystems for gas-engine heat pumps. Topical report, April 1987-October 1988, 15:102 (R;US)
Rasnick, W.H., *See* Hebble, T.L., 15:1001
Ratigan, J.L., *See* Osnes, J.D., 15:142
Ratnakumar, B.V., Electrochemical behavior of niobium triselenide cathode in lithium secondary cells, 15:572 (BA;US)
See Distefano, S., 15:554
Ratner, M.T., *See* Noto, M.G., 15:964
Raup, D.M., Impact as a general cause of extinction: A feasibility test, 15:1516 (RA;US)
Ravizza, D.L., *See* Mitchell, A.C., 15:1604
Rawool, M., *See* Garnett, R., 15:1729
Rayment, R., Domestic warm-air heating systems using low-grade heat sources, 15:673 (R;GB)
Raymond, T.D., Pulse train amplification in KrF, 15:1039 (BA;US)
Rayner, S.F., [Managing the global environment]: Foreign trip report, September 9, 1989–September 23, 1989, 15:1261 (R;US)
Razavi, H., New era of petroleum trading: Spot oil, spot-related contracts, and futures markets. Technical paper, 15:67 (R;US)
Rea, K., *See* Bloom, I., 15:550
Read, A.L. Jr., *See* Ford, W.T., 15:1727
Reagan, D., *See* Agostini, R.C., 15:1014
Reardon, P.C., *See* Luna, R.E., 15:208
Reass, W.A., Electrical insulation system for the shell-vacuum vessel and poloidal field gap in the ZTH machine, 15:1949 (R;US)
High speed transfer switch with 50 kA and 50 kV, 15:1953 (R;US)
See Boenig, H.J., 15:1960
See Bultman, D.H., 15:1954
See Schrank, L.S., 15:1955
Redey, L., *See* Bloom, I., 15:550
Reeme, T.L., A model for the future: Innovative combination of technologies for soil and groudwater VOC [volatile organic compound] remediation, 15:1327 (R;US)
Rego, J.H., *See* Buddemeier, R.W., 15:171
Reichel, P., Microprocessor controlled Moessbauer spectrometer, 15:1176 (RA;DD)
Reiger, J.T., Effective sample labeling, 15:167 (R;US)
Reike, H., Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)
Reilly, J.J., *See* Chen, M., 15:1883
Reimold, W.U., Report on an international workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure, 15:1517 (RA;US)
Reinelt, D.A., *See* Kraynik, A.M., 15:56
Reinhardt, F.W., *See* Guidotti, R.A., 15:577
Reiser, C., *See* Raymond, T.D., 15:1039
Reisner, D., Conventional and foam nickel electrodes in the stabilized high energy nickel-zinc battery system, 15:580 (BA;US)
Reiss, D.A., *See* Kroes, R.L., 15:946
Remelka, J.P., *See* Bazhenov, A.V., 15:850
Remington, S.M., St. Charles county well field monitoring project: Quarterly report, July, August and September 1989, 15:144 (R;US)
Remy, F.N., Flow-assisted corrosion-consequences for piping, 15:378 (J;US)
Renner, T.R., Multisegmented ionization chamber dosimetry system for flight ion beams, 15:1208 (J;NL)
Rensberger, K.J., Laser-induced fluorescence determination of temperatures in low pressure flames, 15:978 (J;US)
Repond, J., The τ one-prong problem and recent measurements by the HRS [High Resolution Spectrometer] collaboration, 15:1719 (R;US)
Reso, H., *See* Mahrenholtz, O., 15:741
Ressel, P., *See* Wesch, W., 15:1855
Reyes, W.B., Downstream ray tracing in beam-optics codes. Final report, September 1984-September 1987, 15:1100 (R;US)
Reynolds, J.G., *See* Beret, S., 15:62
Reynolds, S.P., *See* Dickel, J.R., 15:1611
Rezepov, V.A., *See* Volkovskaya, E.I., 15:941
Rhodes, D.W., Control of clarity and radioactivity in fuel storage basin water, 15:136 (RA;US)
Rhyne, J.J., *See* Fernandez-Baca, J.A., 15:1849
See Jorgensen, J.D., 15:1869
Ribaudo, C., *See* Mazumder, J., 15:754
Ribe, F.L., Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-Wave heating: Progress report No. 3, July 16, 1988–July 15, 1989, 15:1892 (R;US)
Ricci, S.A., *See* Freeman, K.H., 15:1587
Rice, A.R., Dynamics of exploding magma chambers: Implications for K-T volcanism and mass extinctions, 15:1518 (RA;US)
Richards, D.R., *See* Dabrowski, B., 15:823

See Pei, S.Y., 15:821
See Wagener, T.J., 15:854
Richards, P.L., Superconducting components for infrared and millimeter-wave receivers, 15:1011 (J;US)
Richardson, B.S., [French technological progress in the field of robotics and teleoperation]: Foreign trip report, September 9,1989–September 30, 1989, 15:1991 (R;US)
Richlen, S.L, Corrosive resistant heat exchanger, 15:729 (P;US)
Richter, D., *See* Maerten, H., 15:1196, 15:1197
Rickel, D., *See* Blanc, E., 15:1690
Rickert, P.G., *See* Chiarizia, R., 15:1345
Riley, J.C., Radiative capture of tensor and vector polarized deuterons by ^{3}H at 400 keV, 15:1784 (J;US)
Riley, R.A., *See* Baranoski, M.T., 15:86
Riley, R.H., *See* Johnson, L.R., 15:106
Rinard, P.M., A delayed-neutron monitor for a liquid-waste stream with high gamma-ray intensity, 15:151 (R;US)
Monitoring a liquid waste stream with a delayed-neutron instrument, 15:215 (R;US)
Rinehart, B.N., *See* Sommers, G.L., 15:234
Ringel, S.A., Material quality and design optimization for high efficiency GaAs solar cells, 15:266 (BA;US)
Ringo, G.R., *See* Freedman, M.S., 15:1779
Riordan, C.J., *See* Hulstrom, R.L., 15:239
Rios, V.H., MHD simulation in space plasma, 15:1685 (RA;BR)
Ristinen, R., *See* Skulski, W., 15:1821
Rittenhouse, P.L., [Gas-cooled reactor materials]: Foreign trip report, June 11–16, 1988, 15:382 (R;US)
See Blass, J.J., 15:385
Ritter, H.G., Collective flow measured with the Plastic Ball, 15:1807 (R;US)
Ritz, H.J., *See* Bartok, W., 15:312
Rivera, E.S., Specific activity determination of ^{125}I labelled prolactin by receptor and radioinmunological self-displacement methods, 15:1399 (RA;AR)
Rivers, M.L., *See* Chen, J.R., 15:1212
Rives, G.D., *See* Olin, R.C., 15:1267
Rizk, T.A., *See* Lee, R.R., 15:1302
Rizwan-uddin, Dynamic analysis of heated channels with time-dependent inlet temperature, heat flux, and pressure drop, 15:448 (J;US)
Rizzo, T.G., New-quark and -lepton production at high-energy e^+e^- colliders, 15:1749 (J;US)
Roberson, P.L., *See* Carlson, R.D., 15:1839
Robert, H.M.B., Experimental study of atmospheric gases by electron impact technique, 15:1557 (RA;BR)
Roberto, F.F., *See* Ward, T.E., 15:7
Roberts, M.W., Analysis of a hypothetical criticality excursion during misloading of a high-capacity spent-fuel cask, 15:1008 (J;US)
Roberty, H.B., *See* Rosa, R., 15:1565
Robinson, A.C., Acceleration instability in elastic-plastic solids. II. Analytical techniques, 15:1859 (J;US)
See Swegle, J.W., 15:1860
Robinson, J.C., *See* Bohanick, J.S., 15:346
Robinson, S.M., *See* Hall, R., 15:140
Rocco, J.C., *See* Noto, M.G., 15:964
Rockel, B., Parameterization of ice- and water clouds and their radiation-transport properties for large-scale atmospheric models, 15:1237 (R;DE;In German)
Roddy, D.J., Computer modeling of large asteroid impacts into continental and oceanic sites: Atmospheric, cratering, and ejecta dynamics, 15:1532 (RA;US)
Rodgers, J., *See* Destler, W.W., 15:1104
Roederer, J.G., Global problems in solar-terrestrial research, 15:1635 (RA;BR)
Roedig, M., *See* Kwasny, R.J., 15:775
Roemmelt, J.C., *See* Bidelman, W.P., 15:1605
Rogers, E., *See* Prodell, A.G., 15:1118
Rogers, F.J., Equation of state and opacity of dense plasmas, 15:1603 (R;US)
Rogers, J.D., *See* Boenig, H.J., 15:1960, 15:1961
Rogers, R.D., *See* McConnell, J.W., 15:148
Rogers, V.C., *See* Sandquist, G.M., 15:1438
Roglans, J., *See* Spinrad, B.I., 15:413
Rohach, A.F., *See* Danofsky, R.A., 15:405
Rohatgi, A., *See* Pang, S.K., 15:904
See Ringel, S.A., 15:266
Rood, A.S., Contaminant transport in the Snake River Plain Aquifer: Phase 1, Part 1: Simple analytical model of individual plumes, 15:1298 (R;US)
Rosa, R., Two forecasts for investigation of generation mechanism of sunspots, 15:1565 (RA;BR)
Rose, B., *See* Aubrey, D.R., 15:324
Rose, W.W., *See* Merlo, C.A., 15:701
Roseman, R.D., *See* Davison, W.W., 15:817
Rosen, M.D., *See* London, R.A., 15:1219
Rosenblatt, M., *See* Roddy, D.J., 15:1532
Rosenfeld, A., Opportunities for conservation and alternative energy technologies, 15:638 (RA;US)
Rosenthal, M.A., Health, Safety, and Environment Division annual report, 1988, 15:1284 (R;US)
Rosenwald, R.D., *See* Gu, Yeming, 15:1552
Rosev, B.J., *See* Boenig, H.J., 15:1960, 15:1961
Rosner, J.L., Direct-photon searches as tests for unconventional high-energy electroweak interactions, 15:1773 (J;US)
Ross, D.W., *See* Wiley, J.C., 15:1893
Ross, M., Shock compression studies of condensed matter, 15:947 (R;US)
Ross, R. Jr., *See* Mon, G., 15:901
Ross, W.A., *See* Schneider, K.J., 15:204
Rossano, M.J., Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
Rosse, C., Modulation of lymphopoiesis: Annual report, 15:1424 (R;US)
Rosso, M.J. Jr., Design and performance of an air-cooled ion exchange membrane fuel cell, 15:668 (BA;US)
Rostoker, G., *See* Eastman, T.E., 15:1541
Roth, D.J., *See* Generazio, E.R., 15:828
Roth, E., Separation of tritium from other hydrogen isotopes, 15:220 (R;FR)
Rothe, K.E., *See* Ryan, P.M., 15:1923
Rothrock, R.B., *See* Howell, J.A., 15:1095
Rotscheidt, H., Studies on the hard scattering in photon-proton reactions in the energy range from 65 to 175 GeV at the CERN Ω spectrometer, 15:1722 (R;DE;In German)
Rotter, H., *See* Kleinwaechter, P., 15:1178
Rouget, R., *See* Bugnet, B., 15:582
Rouse, L.C., Regulatory actions and initiatives based on results of NRC operational safety assessments of fuel cycle facilities, 15:210 (J;US)
Rowcliffe, A.F., [Materials for magnetic fusion energy systems]: Foreign trip report, August 30, 1988–September 9, 1988, 15:1967 (R;US)
Rowcliffe, D.J., Cemented NbC-Co for geothermal drilling applications: Final report, 15:298 (R;US)
Rowland, M.L., *See* Ward, T.E., 15:7
Rowlette, J.J., *See* Attia, A.I., 15:586
Roy, P., 'Hytec' - New concept for a thermally regenerative electrochemical cell, 15:670 (BA;US)
Ruberth, F., *See* Kaschmitter, J., 15:1997
Ruben, A., *See* Maerten, H., 15:1831
Rubin, A.B., *See* Seibert, M., 15:1378
Rubio, M.C., Influence of monofluormethylhistidine (MFMH) on the mammary adenocarcinoma M-2, 15:1398 (RA;AR)
Rudowicz, M., Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector, 15:1170 (R;DE;In German)
Rudy, K.E., *See* Levine, S.H., 15:479
Ruediger, J., Investigation of scintillation materials, 15:1177 (RA;DD)
See Kleinwaechter, P., 15:1178
Rueter, K.J., *See* Vargo, M.F., 15:177
Ruggieri, M.R., *See* Buddemeier, R.W., 15:171
Ruhle, M., *See* Kuwabara, M., 15:804
Rule, D.L., Low-temperature thermal conductivity of composites: Alumina fiber/epoxy and alumina fiber/PEEK, 15:889 (R;US)
Ruschman, M.K., *See* Gonczy, J.D., 15:1124
Russell, D.A., Laser-mixing processes. Final report, 1 July 1977-31 October 1978, 15:1025 (R;US)

Ruzhin, Yu.Ya., *See* Korobeinikov, V.G., 15:1898
Ruzic, D.N., *See* Caughman, J.B.O. II, 15:1925
Ryan, P.M., Determination of ICRF antenna fields in the vicinity of a 3-D Faraday shield structure, 15:1923 (R;US)
See Whealton, J.H., 15:1924
Ryder, D.E., Application of QA to R & D support of HLW programs, 15:195 (J;US)
Ryder, G., *See* Sharpton, V.L., 15:1523
Ryu, D., Distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter dominated universe, 15:1572 (R;US)
Ryu, Dongsu, Neutron stars and white dwarfs in galactic halos, 15:1589 (R;US)

S

Saadatmand, K., Automatic control of a laboratory system, 15:1103 (J;US)
Saadi, M., Closed string field theory from polyhedra, 15:1768 (J;US)
Saavedra, N., *See* Arriagada, M.A., 15:1802
Sabisky, E., *See* Wallace, W., 15:258
Sabisky, E.S., The odyssey of thin-film amorphous silicon photovoltaics, 15:898 (BA;US)
Sackstede r, K.R., *See* Vento, D.M., 15:974
Sagan, C., *See* Khare, B.N., 15:1609
Saha, H.P., Accurate *ab initio* calculation on the low-energy elastic scattering of electrons from helium, 15:1712 (J;US)
Sahai, Y., *See* Bittencourt, J.A., 15:1648
See Fagundes, P.R., 15:1653
See Sobral, J.H.A., 15:1668
Said, M.R., Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$, 15:876 (R;US)
Saio, Hideyuki, *See* Hachisu, Izumi, 15:1583
Saito, S., *See* Miura, Y., 15:1504
Saito, Shozo, *See* Sakakiyama, Tsutomu, 15:1089
Saka, N., *See* Suh, N.P., 15:1062
Sakai, F., *See* Ide, T., 15:1945
Sakai, Kiyoshi, *See* Sano, Kenichi, 15:546
Sakakiyama, Tsutomu, Behaviors and scale effect of wave reflection and run-up on armored breakwater, 15:1089 (R;JP;In Japanese)
Saksena, R.C., *See* Stanford, J.L., 15:1586
Sakurai, Takeichi, *See* Taniguchi, Haruhito, 15:313
Sale, M.J., *See* Sommers, G.L., 15:234
Salem, J., *See* Jenkins, M.G., 15:824
Sales, B.C, *See* Boatner, L.A., 15:197
Sales, B.C., *See* Chakoumakos, B.C., 15:844
Salim, P., A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme, 15:512 (J;US)
Saling, J.H., *See* Moran, B.W., 15:213
Salk, M.S., *See* Houlberg, L.M., 15:1299, 15:1300
Salmeron, M., *See* Ogletree, D.F., 15:781
Salomon, R.E., *See* Kebede, A., 15:851
Saltzman, J., DOE policy: Waste management QA, 15:193 (J;US)
Sammells, A.F., *See* Tsai, K.J., 15:555
Samsel, E.G., *See* Debsikdar, J.C., 15:825
Samuel, B., *See* Wiebe, L.I., 15:963
Samuel, T.J., *See* Crowe, R.D., 15:458
Sandenaw, T.A., Multiple martensitic transformations, incommensurate/commensurate phases and charge-density-wave states in plutonium metal: Their consequences, 15:777 (R;US)
Sandfor, J.G., *See* Joshua, A.V, 15:1397
Sandiford, A.T., *See* Aubrey, D.R., 15:324
Sandoval, R.P., *See* Mings, W.J., 15:130
Sandquist, G.M., A simple model for discounting radiation health effects risks with time, 15:1438 (J;US)
Sanford, N.M., *See* Burnham, A.K., 15:631
Sangster, T.C., *See* Fowler, M.M., 15:1207
Sankar, S.U., *See* Langacker, P., 15:1754
Sann, H., *See* Pochodzalla, J., 15:1801
Sano, Kenichi, Acoustic monitoring of BWR main steam safety relief valves, 15:546 (J;US)
Sant'Anna, A.S., *See* Afonso, G.B., 15:1676
Santelli, R.E., Geochemical study of main elements and trace elements in soils of three profiles in the state of Santa Catarina, 15:920 (R;BR;In Portuguese)
Santos, P.R.G., Solvents extraction of niobium and tantalum, 15:940 (R;BR;In Portuguese)
Santos, R.S. dos., Utilization of ADE method in the numerical resolution of the neutron Kinetic equation, 15:424 (R;BR;In Portuguese)
Sarangapani, S., Non-noble electrocatalysts for alkaline fuel cells, 15:664 (RA;US)
Sarcevic, I., QCD minijet cross sections, 15:1771 (J;US)
Sarker, S., Bosonic mean-field theory of quantum Heisenberg spin systems: Bose condensation and magnetic order, 15:1866 (J;US)
Sarre, G., *See* Planchat, J.P., 15:574
Sasaki, Misao, Gravitational radiation from extreme Kerr black hole, 15:1594 (R;US)
See Futamase, Toshifumi, 15:1591
Satake, Koji, *See* Taniguchi, Haruhito, 15:313
Sato, M., *See* Tranquada, J.M., 15:852
Sato, Nobuyuki, *See* Taniguchi, Haruhito, 15:313
Saunders, G.K., *See* Beech, J.C., 15:674
Savoia, P.J., Use of Axially zoned gadolinia in GE [General Electric Co.] BWR reload fuel, 15:342 (J;US)
Savoy-Navarro, A., *See* Bengtsson, H., 15:1751
Sawant, H.S., MM. wavelength spectroscopic observations of solar activity region, 15:1566 (RA;BR)
Sawchuk, A.A., *See* Steier, W.H., 15:1069
Saxena, A., *See* Landes, J.D., 15:802
Sayer, B., Hot fusion, cold fusion, 15:1886 (J;FR;In French)
Sayers, D.E., Research at and operation of the material science x-ray absorption beamline (X-11) at the National synchrotron light source: Annual progress report, 15:1146 (R;US)
Scalise Junior, E., Preliminary results of recent centimetre wavelength radio observation of Mercury, Venus, Mars, Jupiter and Saturn, 15:1558 (RA;BR)
Scamehorn, J.F., *See* Harwell, J.H., 15:50
Schade, H.J., *See* Schmal, N., 15:396
Schaefer, R., Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress, 15:772 (R;DE;In German)
Schaller, S.C., *See* Howell, J.A., 15:1095
Schatz, A.H., *See* Bramble, J.H., 15:2002
Schatz, K.W., Water spray mitigation of hydrofluoric acid releases, 15:727 (R;US)
Scheid, H.W., Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report, 15:647 (R;US)
Scheps, R., End-pumped Nd:BEL laser performance. Professional paper, 15:1020 (R;US)
Nd:BEL laser pumped by laser diodes, 15:1019 (R;US)
Scherrer, P.H., Solar g-mode oscillations: Comparison of SMM-ACRIM and ground-based observations. Final report, 1 July 1987-30 June 1988, 15:1576 (R;US)
Scheurer, J.N., *See* Stolterfoht, N., 15:1785
Schicker, R., *See* Ritter, H.G., 15:1807
Schiffer, J.P., *See* Smith, L.C., 15:1783
Schillig, J.B., *See* Boenig, H.J., 15:1960, 15:1961
Schils, G.F., *See* Ochoa, E., 15:1080
Schily, U., *See* Wohlfahrt-Mehrens, M., 15:566
Schimitschek, E.J., *See* Scheps, R., 15:1019, 15:1020
Schirber, J.E., *See* Hundley, M.F., 15:861
Schlachter, A.S., *See* Schneider, D., 15:1711
Schlesser, J.A., *See* Spriggs, G.D., 15:120, 15:457
Schlichting, J., Molybdenum disilicide as a component of modern composites for application at high temperatures, 15:887 (TJ;US)
Schlobohm, S.L., *See* McCampbell, C.B., 15:1223
Schloh, M., *See* Chen, M., 15:1883
Schlottmann, P., *See* Kebede, A., 15:851
Schmal, N., The TEX-I real-time expert system, applied to situation assessment for the SNR-300 reactor, 15:396 (J;US)
Schmidt, H.R., *See* Ritter, H.G., 15:1807
Schmidt, R.M., Crater size estimates for large-body terrestrial impact, 15:1519 (RA;US)
Schmitz, B., Marine and continental K-T boundary clays compared, 15:1520 (RA;US)
Schmuss, R. van, *See* Tassinari, C.C.G., 15:1469
Schneider, B.J., *See* Prince, K.R., 15:1332

Schneider, C.M., *See* Rinard, P.M., 15:151, 15:215
Schneider, D., Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles, 15:1711 (J;US)
Schneider, J.F., *See* Boparai, A., 15:24
Schneider, K.J., Estimated routine radiation doses to transportation workers in alternative spent-fuel transportation systems, 15:204 (J;US)
Schneider, M., $^{12}C^{16}O$ laser frequency tables for the 34.2 to 62.3 THz (1139 to 2079/cm) region, 15:1035 (R;US)
Molecular-dynamics simulation of thin-film growth, 15:899 (BA;US)
Schneider, O., *See* Grimberg, B.I., 15:1642
See Grimberg, B.J., 15:1643
See Zelle, M.A. van, 15:1645
Schnurr, N.M., Thermal analysis of the CPFR [Confinement Physics Research Facility]/ZTH apparatus, 15:1944 (R;US)
Schober, S., *See* Thun, M.J., 15:202
Scholz, T., *See* Kleinwaechter, P., 15:1178
Schoo, C.J., *See* Gonczy, J.D., 15:1124
Schramm, G., Environmental management and economic development, 15:625 (R;US)
Schrank, L.S., Remote controlled signal conditioner and fiber optic data link system development CPRF (Confinement Physics Research Facility), 15:1955 (R;US)
Schreck, B., *See* Wohlfahrt-Mehrens, M., 15:566
Schreiber, J.J., Completion of the Shippingport reactor decommissioning, 15:487 (R;US)
Schriever, R.L., Status of inertial confinement fusion, 15:1974 (J;US)
Schroder, A.M., *See* Noto, M.G., 15:964
Schroder, D.K., *See* Joardar, K., 15:290
Schroeder-Obst, D., Quantitative analysis of the precipitation conditions in fine grained structural steel for materials characterization, 15:774 (R;DE;In German)
Schuchman, J.C., X-ray lithography source (SXLS) vacuum system, 15:1106 (R;US)
Schuhmann, R.B., *See* Hill, J.C., 15:1789
Schuller, I.K., *See* Schneider, M., 15:899
Schultz, D.E., The development of an expert system to tune a beam line, 15:1126 (R;US)
Schultz, P.H., Oblique impacts: Catastrophic vs. protracted effects, 15:1521 (RA;US)
Schulze, W., *See* Kleinwaechter, P., 15:1178
See Winter, G., 15:1179, 15:1189
Schuraytz, B.C., *See* Murali, A.V., 15:1506
See Sharpton, V.L., 15:1523
Schuster, E., *See* Ortlepp, H.G., 15:1188
Schuster, J.R., COLD-SAT: An orbital cryogenic hydrogen technology experiment, 15:990 (R;US)
Schuster, S.H., *See* Roddy, D.J., 15:1532
Schuttler, H., *See* Fedro, A.J., 15:1876
Schwartz, E.L., *See* Frederick, C., 15:1394
Schwartz, R.J., *See* Banghart, E.K., 15:269
Schwarz, R.B., *See* Hundley, M.F., 15:861
Schwarzenberg, F., *See* Fromm, W.D., 15:934
Schwegler, J., *See* Kebede, A., 15:851
Schweika, W., Short-range order in Ising-like models with many-body interactions: Description via effective pair interactions, 15:1865 (J;US)
Schweitzer, M., Electricity savings and one and two years after weatherization: A study of 1986 participants in Bonneville's Residential Weatherization Program, 15:653 (R;US)
Schweitzer, R., *See* Burns, P.J., 15:1988
Schwengner, R., *See* Kleinwaechter, P., 15:1178
Sciacca, F.W., Generic cost estimates for retrofit activities at nuclear power plants, 15:421 (J;US)
Scofield, J.H., Angular and polarization correlations in photoionization and radiative recombination, 15:1713 (J;US)
Scolnik, A.J., *See* Rubio, M.C., 15:1398
Scott, C.D., Fluidized-bed bioreactor process for the microbial solubilization of coal, 15:14 (P;US)
See Watson, J.S., 15:181
Scott, J.R., *See* Joshua, A.V, 15:1397
Scott, W., *See* Kaschmitter, J., 15:1997
Scully, J.R., Hydrogen assisted cracking of palladium modified PH 13-8 Mo stainless steel, 15:799 (R;US)
Seale, R.L., The University of Stuttgart IKE/University of Arizona student research program, 15:436 (J;US)
Sealock, L.J. Jr., *See* Elliott, D.C., 15:254
Sebo, D.E., *See* Nelson, W.R., 15:508
Sebold, F.D., Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)
Secker, J.R., *See* Kapil, S.K., 15:361
Secunde, R.R., Solar dynamic power module design, 15:277 (R;US)
Sedman, C.B., *See* Stern, R.D., 15:311
Seeliger, D., *See* Maerten, H., 15:1197
Seely, J.F., *See* Brown, C.M., 15:1043
See Ekberg, J.O., 15:1042
See Feldman, U., 15:1044
Segalov, Z., *See* Destler, W.W., 15:1104
Seibert, M., Spectral, photophysical, and stability properties of isolated photosystem II reaction center, 15:1378 (J;US)
Seidel, W., Double grid avalanche counter with large dynamic range, 15:1185 (RA;DD)
Sella, R.L., Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986, 15:1268 (R;US)
Seki, R., *See* Kiritsis, E., 15:1816
Sellers, C.H., *See* Debsikdar, J.C., 15:825
Sellschop, J.P.F., *See* Tredoux, M., 15:1531
Sengers, J.V., *See* Olchowy, G.A., 15:949
Sengupta, S., Targeted chlorination schedules: Final report, 15:302 (R;US)
Senthilathipan, V., Laser flash photolysis as a probe of redox protein-membrane interactions: Effect of binding of spinach plastocyanin and horse cytochrome c to lipid bilayer vesicles on the kinetics of reduction by flavin semiquinone, 15:1379 (J;US)
Sepkowski, J.J. Jr., Periodicity of extinction: A 1988 update, 15:1522 (RA;US)
Seppae, H., Analysis of an R-SQUID noise thermometer. Doctoral thesis, 15:994 (R;FI)
Serbeto, A. de P.B., Spaced-based free electron laser, 15:1686 (RA;BR)
Sergey, G.P., *See* Petravick, D.L., 15:2010
Setoguchi, K., *See* Koger, K.H., 15:466
Shah, P.P., *See* Johnson, R.W., 15:3
Shamoto, S., *See* Tranquada, J.M., 15:852
Shamsi, A., *See* France, J.E., 15:88
Shanfield, Z., Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)
Shanks, H.R., *See* Shinar, R., 15:951
Shannon, L.M., Molecular biology of seed storage proteins and lectins, 15:1367 (B;US)
Shapira, Y., *See* Wu, M.K., 15:879
Shapiro, B.H., *See* Delene, J.G., 15:350
Shapiro, N.L., *See* Beaudreau, J.J., 15:362
Share, G.H., Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)
Sharma, S., *See* Oversluizen, T., 15:1105
Sharpe, W.N., Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989, 15:753 (R;US)
Sharpton, V.L., K-T impact(s): Continental, oceanic or both, 15:1523 (RA;US)
Sheinberg, H., *See* Jahan, M.S., 15:842
Shelton, R.N., *See* Peng, J.L., 15:853
Shelton, W.A. Jr., [Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)
Shen, D.H., Evaluation of mixed solvent electrolytes for ambient temperature secondary lithium cells, 15:567 (BA;US)
See Subbarao, S., 15:563

Shen, D.S., Dangling-bond states in a-Si,Ge:H,F measured by temperature-dependent μtau, 15:902 (BA;US)
Shen, Z., *See* Lindberg, P.A.P., 15:847, 15:857
See Wells, B.O., 15:863
Shen, Z.X., Electronic structure of monoclinic $BaBiO_3$, 15:1873 (R;US)
Shepard, K.W., Status of RF superconductivity at Argonne, 15:1115 (R;US)
Status of superconducting rf cavity development, 15:1111 (R;US)
Shepard, T.D., *See* Ryan, P.M., 15:1923
Sherman, D.F., Hydrogen dissolution in and relesease from nonmetals, 15:838 (J;NL)
Sherman, R.H., *See* Enoeda, M., 15:1950
Sherwood, D.R., Identification of contaminants of concern in Hanford ground waters, 15:1341 (R;US)
Shi, D., Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system, 15:862 (J;US)
See Singh, J.P., 15:848
Shi, Donglu, *See* Balachandran, U., 15:822
Shibya, G., *See* Miura, Y., 15:1504
Shillenn, J.K., Choosing nuclear engineering: A survey of nuclear engineering undergraduates, 15:412 (J;US)
Shima, T., *See* Garnett, R., 15:1729
Shimogaki, Hisashi, Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
Shimotake, H., *See* Varma, R., 15:801
Shinar, J., *See* Shinar, R., 15:951
Shinar, R., The interaction of oxygen molecules with amorphous Ge, Ge:H, and some Ge:C:H alloys, 15:951 (J;US)
Shinohara, M., *See* Kitamura, T.-J., 15:1631
Shirane, G., *See* Graf, H.A., 15:808
See Thurston, T.R., 15:856
See Tranquada, J.M., 15:852, 15:1868
See Yamada, K., 15:855
Shis, B.S., *See* Oates, D.E., 15:983
Shmayda, W.T., *See* Longhurst, G.R., 15:1940
Shniger, O.N., *See* Kalinin, A.A., 15:942
Shockley, W.E., *See* Beahm, E.C., 15:356
Shokair, I.R., Detuning ion hose with a time varying axial magnetic field, 15:1697 (R;US)
Shonka, D.B., *See* Davis, S.C., 15:696
Shorrock, L.D., *See* Henderson, G., 15:675
Short, S.A., Probabilistic evaluation of main coolant pipe break indirectly induced by earthquakes: Savannah River Project L and P Reactors, 15:506 (R;US)
Short, S.M., Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)
Shuh, D.K., *See* Hsu, L., 15:751
Shukolyukov, Yu.A., *See* Kolesnikov, E.M., 15:1494
Shvarts, D., *See* Bar-Shalom, A., 15:1915
Shyu, S.G., *See* Davison, W.W., 15:817
Siebert, B.R.L., Calibration of individual neutron monitors in terms of H_p and the new ICRU dose-equivalent quantities, 15:1845 (J;US)
Siebert, L.D., *See* Maynard, R.L., 15:1037
See Stanley, J.G., 15:1038
Siegel, J.S., Clean-coal technologies - a Midwest project update, 15:642 (RA;US)
Siekhaus, W., *See* Ogletree, D.F., 15:781
Siemiarczuk, T., *See* Ritter, H.G., 15:1807
Sievers, A.J., Development of the cn- solid-state vibrational laser. Final report, 1 August 1985-31 October 1988, 15:1018 (R;US)
See Kaplan, S.G., 15:858
Sigal, G.B., *See* Miller, D.A., 15:419
Sigurdsson, H., Assessment of the atmospheric impact of volcanic eruptions, 15:1524 (RA;US)
Sik, J., *See* Ryu, Dongsu, 15:1589
Sill, C.W., Determination of thorium, uranium and transuranium isotopes in siliceous and refractory materials by high-resolution alpha spectrometry, 15:111 (R;US)
Sill, D.S., *See* Sill, C.W., 15:111
Sills, E.D., Evaluation of advanced computer systems for performing system thermal-hydraulic modeling, 15:366 (J;US)
See Doster, J.M., 15:358
Silva, C.P.G. da., *See* Mestnik, S.A.C., 15:960
Silva, C.R.R., *See* Nobrega, A.W. da, 15:922
Silva, C.R.S., *See* Nobrega, A.W. da, 15:923
Silva, R.J., *See* Buddemeier, R.W., 15:171
Silvera, I.F., Fundamental properties of spin-polarized quantum systems: Technical progress report, November 1988–October 1989, 15:1692 (R;US)
Silvester, L.F., *See* Chang, O.K., 15:569
Silvikin, V.V., *See* Van, N.A.B., 15:1673
Sime, D.G., Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)
Simion, G.P., *See* Sciacca, F.W., 15:421
Simkin, T., Volcanoes and global catastrophes, 15:1525 (RA;US)
Simmons, M.L., *See* Burns, P.J., 15:1988
Simon, D., *See* Kim, J.H., 15:1187
Simonich, D.M., *See* Batista, P.P., 15:1647
Simpson, J.R., *See* Whiteman, C.D., 15:1245, 15:1247
Sims, J.R., *See* Bultman, D.H., 15:1954
Singer, B., *See* Fraenkel-Conrat, H., 15:1464
Singer, J., Corrosion testing of candidates for the alkaline fuel cell cathode, 15:665 (RA;US)
Singer, M.I., Research directions in enhanced oil recovery, 15:58 (B;US)
Singh, J.J., A slow positron beam generator for lifetime studies, 15:222 (R;US)
Singh, J.P., Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
See Kupperman, D.S., 15:849
Singh, M.K., A comparative analysis of alternative fuel infrastructure requirements, 15:745 (R;US)
Sinha, R., *See* Gary, S.P., 15:1614
Sinha, S.K., *See* Pei, S.Y., 15:821
Sircar, S., *See* Mazumder, J., 15:754
Sisk, R.C., *See* Wu, M.K., 15:879
Sitarski, M.A., Radiant heating of small multiphase fuel droplets, 15:36 (BA;US)
Sithole, I., *See* Debus, R.J., 15:1384
Sjoblom, G.L., Safety team assessments at NRC [Nuclear Regulatory Commission]-licensed fuel facilities, 15:209 (J;US)
Skay, S.A., *See* Berg, R.M., 15:339
Skinrod, A.C., *See* Castro, M., 15:287
Skjellum, A., Highly concurrent dynamic simulation in chemical engineering, 15:1999 (B;US)
Skogen, F.B., Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers, 15:343 (J;US)
Skomarovsky, V.S., *See* Korobeinikov, V.G., 15:1898
Skulski, W., Linear momentum transfer in the reaction of 64–269 MeV ^{3}He with ^{238}U, 15:1821 (J;US)
Slattery, W.L., *See* Cameron, A.G. W., 15:1607
Sleep, N., *See* Zahnle, K., 15:1540
Sliepcevich, C.M., *See* Lee, I., 15:23
Sloan, R.E., Biostratigraphic case studies of six major extinctions, 15:1526 (RA;US)
Slovik, G.C., Analysis of postulated unscrammed loss of flow in SAFR using SSC, 15:516 (J;US)
Small, G.J., *See* Lee, I., 15:957
Smalley, L.L., Ideal black hole fluid, 15:1571 (R;US)
Ideal black hole gas, 15:1593 (R;US)
Smallwood, D.O., Characterizing transient vibrations using band limited moments, 15:1233 (R;US)
Smit, J., Impact and extinction signatures in complete Cretaceous-Tertiary (K-T) boundary sections, 15:1527 (RA;US)
Smit, P., *See* Smit, J., 15:1527
Smith, A.E., *See* Baca, P.M., 15:895
Smith, A.M., Lessons learned in a systemwide implementation of RCM, 15:306 (J;US)
Smith, C.B., *See* Tredous, M., 15:1531
Smith, C.L., *See* Cantor, C.R., 15:1387
See Mathew, M.K., 15:1385, 15:1386, 15:1388
Smith, D.L., *See* Meadows, J.W., 15:1918
Smith, E.T., Nuclear power: A public policy issue, 15:632 (J;US)

Smith, J.G., *See* Ford, W.T., 15:1727
Smith, J.L., *See* Jahan, M.S., 15:842
Smith, K., Data base of cross sections and reaction rates for hydrogen ion sources, 15:1703 (J;NL)
See Fingleton, D.J., 15:1317
Smith, L.C., Reaction $^3He(\pi^+,pp)p$ at T_π=350 and 500 MeV, 15:1783 (J;US)
Smith, M.E., The DWPF Melter proposed heat up sequence, 15:178 (R;US)
Smith, N.R., A k_{eff} search and optimization using noisy differentials, 15:1005 (J;US)
See Morioka, Shinichi, 15:1006
Smith, P.J.Q., Coal combustion modeling: Particulate and gas phase heat transfer effects, 15:34 (B;US)
Smith, R.I., *See* Schneider, K.J., 15:204
Smith, R.L., *See* Ballard, E.O., 15:1947
Smith, R.P., Oil shale mining and material handling: Considerations for future research and development, 15:104 (R;US)
Smith, T.L., *See* VanderLaan, J.F., 15:1913
Smith, Z.E., *See* Shen, D.S., 15:902
Smolen, G.R., Summary of experimental and calculational results from the joint USDOE/PNC criticality data development program, 15:119 (R;US)
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)
See Funabashi, H., 15:118
See Spriggs, G.D., 15:120, 15:457
Smolik, G.R., Volatility from copper and tungsten alloys for fusion reactor applications, 15:1938 (R;US)
Smoot, L.D., *See* Kramer, S.K., 15:20
Snowdon, G.M., *See* Maddalena, D.J., 15:962, 15:1400
Sobiella, M., *See* Manfrass, P., 15:1184, 15:1405
Sobolev, Ya. P., Near-equatorial ion-cyclotron phenomenon in upper ionosphere by satellite data, 15:1636 (RA;BR)
Sobral, J.H.A., Incoherent scatter detection of downward proton fluxes into the ionospheric F-region over Arecido during July 1986 solar minimum, 15:1668 (RA;BR)
Neutral wind control over plasma bubbles zonal velocites at Brazilian low latitudes, 15:1667 (RA;BR)
Poleward propagation of postsunset ionospheric plasma depletions as detected through meridional scanning airglow (λ=630 nm) measurements in Brazil, 15:1669 (RA;BR)
See Muralikrishna, P., 15:1661
See Paula, E.R. de, 15:1665
Solberg, D.E., *See* Nelson, W.R., 15:511
Solone, P.J., *See* Wark, J.S., 15:915
Soloviev, V.G., *See* Karadjov, D., 15:1803
Solovjev, S.M., *See* Merla, K., 15:968
Soma, L., *See* Zabot, S., 15:281
Somerville, C., *See* Kunst, L., 15:1380
Sommers, G.L., DOE hydropower program biennial report 1988–1989: (With updated annotated bibliography), 15:234 (R;US)
Somorjai, G.A., *See* Ogletree, D.F., 15:781
Sonder, E., *See* Chakoumakos, B.C., 15:844
Sonnenschein, J., *See* Montano, D., 15:1769
Sopori, B.L., Influence of oxygen on the performance of silicon solar cells, 15:262 (BA;US)
Sorensen, D., *See* Brewer, O., 15:1986
Sorg, T.J., Removal of uranium from drinking water by conventional treatment methods, 15:1347 (R;US)
Souza, G.G.B., *See* Robert, H.M.B., 15:1557
Spalding, B.P., Demonstrations of technology for remediation and closure of Oak Ridge National Laboratory waste disposal sites, 15:165 (R;US)
Spaletta, H.W., *See* Caffrey, A.J., 15:1884
Spangler, B.D., Crystallization of isoelectrically homogeneous cholera toxin, 15:1408 (J;US)
Sparks, C.J., X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)
Sparks, L.L., *See* Rule, D.L., 15:889
Spence, J.C.H., *See* Kuwabara, M., 15:804
Spence, P.A., *See* Howe, T.M., 15:344
Spencer, J.E., Real-time applications of neural nets, 15:2009 (J;US)
Sperling, R.B., The selection and use of VA/VE [Value Analysis/Value Engineering] professionals, 15:999 (R;US)
Spett, B., *See* Janoki, A., 15:1401
Spetz, S.W., The characteristics and effective utilization of a separate burnable absorber, 15:360 (J;US)
Spicer, W. E., *See* Wahi, A. K., 15:880
Spicer, W.E., *See* Lindberg, P.A.P., 15:847, 15:857
See Shen, Z.X., 15:1873
See Wells, B.O., 15:863
Spiczak, G.R., *See* Butler, C.S., 15:2012
Spielberg, H., Differential sensitivity of human leukocyte subpopulations to ultraviolet light, 15:1417 (R;US)
Spindler, G., On the small-signal gain of free-electron lasers in the low-current region, 15:1029 (R;FR)
Spinka, H., *See* Garnett, R., 15:1729
Spinrad, B.I., Studies on the back end of the nuclear fuel cycle, 15:413 (J;US)
See Chung, Sun-Kyo, 15:468
See Danofsky, R.A., 15:405
Spitznagel, J.A., *See* Meier, D.L., 15:260
Spohn, H., *See* Nielaba, P., 15:1856
Sprangle, P., *See* Godlove, T.F., 15:1022
Spriggs, G.D., Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:457 (R;US)
Springborg, M., Interactions between two identical polymer chains studied with first-principles calculations, 15:956 (J;US)
Srinivasan, S., Recent advances in solid polymer electrolyte fuel cell technology with low platinum loading electrodes, 15:659 (RA;US)
See Appleby, A.J., 15:556
Srivastava, S.C., [The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989, 15:959 (R;US)
Srour, J.R., *See* Shanfield, Z., 15:1210
St.Clair, T.L., *See* Singh, J.J., 15:222
Stacy, W.D., *See* Iannello, V., 15:980
Stafford, B., *See* Wallace, W., 15:258
Stanek, R., *See* Garnett, R., 15:1729
Stanford, J.L., Oscillations in D-region absorption at periods of one to two months, 15:1586 (R;GB)
Stang, D.B., *See* Generazio, E.R., 15:828
Staniewicz, R.J., *See* Embrey, J., 15:576
Stanley, J.G., Wideband Nd:glass laser, 15:1038 (BA;US)
See Maynard, R.L., 15:1037
Stara, J.F., *See* Bruins, R.J.F., 15:735
Stary, F., *See* Kotte, R., 15:1181
Steadman, S.G., *See* Chen, M., 15:1883
Stebbins, A., Great attractor really a great wall, 15:1570 (R;US)
Steed, A.J., *See* Ulwick, J.C., 15:1615
Stefan, P.M., *See* Oversluizen, T., 15:1105
Steier, W.H., Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)
Steinberg, M., *See* Grohse, E.W., 15:731
Steingrimsson, B., *See* Aunzo, Z., 15:297
Steininger, K., *See* Kordesch, K., 15:671
Stell, G., Chemical association in simple models of molecular and ionic fluids, 15:955 (J;US)
Stephens, G., *See* Smith, L.C., 15:1783
Stephens, J.R., *See* Petrasek, D.W., 15:759
Stern, R.D., SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
Stevenson, T.N., *See* Kamperschroer, J.H., 15:1970
Stewart, A.J., *See* Kszos, L.A., 15:1443
Stewart, G.R., *See* Fraunberger, G., 15:809
Stewart, K.A., The data acquisition and control system for Thomson scattering on ATF, 15:1976 (J;US)
Stewart, R., *See* Walker, D.S., 15:1264
Stewart, W.A., *See* Conway, L.E., 15:373
Stewart, W.E. Jr., Development of ice self-release mechanisms: Final report, 15:716 (R;US)
Stickford, G.H., *See* Weller, A.E., 15:103
Stith, D.A., *See* Baranoski, M.T., 15:86
Stock, M., *See* Behrens, U., 15:481

Stockli, M.P., Adaptation of dependex fittings to International Standards Organization fittings, 15:1218 (J;US)
Stodolsky, L., *See* Rosner, J.L., 15:1773
Stoffel, T.L., *See* Hulstrom, R.L., 15:239
Stoller, R.E., [Radiation damage correlation for fusion conditions]: Foreign trip report, September 25, 1989–October 5, 1989, 15:1968 (R;US)
Stolterfoht, N., Angular momentum distributions of autoionizing states produced in 1.5 MeV C^{q+} + C_{foil} and C^{q+} + He collisions, 15:1785 (R;FR)
Stolz, W., *See* Degering, D., 15:1545
See Kim, J.H., 15:1187
Stone, G.L., Low-frequency velocity and temperature fluctuations in Katabatic Valley Flows*, 15:1241 (J;US)
Stone, J.L., *See* Sabisky, E.S., 15:898
Stoner, D.L., *See* Dugan, P.R., 15:8
Storini, M., Correlative analyses for geomagnetic indices, cosmic-ray intensities and sunspot numbers recorded since 1937, 15:1556 (RA;BR)
Stoshkov, Yu. I., *See* Van, N.A.B., 15:1674
Stosur, G.I., *See* Singer, M.I., 15:58
Stothers, R.B., *See* Rampino, M.R., 15:1514
Stott, L.D., Cretaceous-Tertiary boundary in the Antarctic: Climatic cooling precedes biotic crisis, 15:1528 (RA;US)
Stowers, I.F., *See* Hoover, W.G., 15:1067
Stozhkov, Y.I., *See* Martin, I.M., 15:1672
Stozhkov, Yu. I., *See* Van, N.A.B., 15:1673
Stradner, H., *See* Preisinger, A., 15:1512
Stradtner, R., *See* Renner, T.R., 15:1208
Strandberg, G.W, *See* Scott, C.D., 15:14
Strayer, M.R., *See* Dean, D.J., 15:1822
Strickler, D.J., *See* Peng, Y.K.M., 15:1888
Stringer, J., *See* Hou, P.Y., 15:803
Strottman, D.D., *See* Oset, E., 15:1738
Strueder, L., Development of novel semiconductor detectors for the detection of ionizing radiation, 15:1171 (R;DE;In German)
Stubbins, J.F., Stress-driven flow of impurities and its implications for embrittlement of structural components in nuclear applications, 15:453 (J;US)
Studier, F.W., Model for how type I restriction enzymes select cleavage sites in DNA, 15:1381 (J;US)
Studley, A., *See* Freeman, K.H., 15:1587
Stuewe, R.B., *See* Howell, J.A., 15:1095
Su, Shiaw-der, *See* Boshoven, J.K., 15:126
Subbarao, S., Advances in ambient temperature secondary lithium cells, 15:563 (RA;US)
See Shen, D.H., 15:567
Subramonian, S., *See* Clifford, D., 15:1346
Sugita, Toshio, *See* Tani, Tatsuo, 15:271
Suh, N.P., Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986, 15:1062 (R;US)
Sullivan, R., *See* Whittenberg, P.L., 15:596
Sullivan, T.J., *See* Lange, R., 15:1437
Summers, L.T., Further studies of transverse stress effects in Cable-In-Conduit Conductors, 15:998 (R;US)
Sundseth, R., *See* Yang, Wen K., 15:1368
Sungaila, Z.F, Low temperature cryoprobe, 15:1015 (P;US)
Sushkov, A.V., *See* Karadjov, D., 15:1803
Susskind, S.M., Charge states of high Z atoms in a strong laser field, 15:1696 (R;US)
Sutter, S.L., *See* du Plessis, L.A., 15:134
Sutton, S.R., *See* Chen, J.R., 15:1212
Sutz, P., *See* Sylvain, C., 15:370
Suzuki, M., *See* Grossbeck, M.L., 15:395
Sviatoslavsky, I.N., *See* Lyon, J.F., 15:1013
Swain, J.E., *See* Wark, J.S., 15:915
Swallow, E.C., *See* Trost, L.H., 15:1728
Swamikannu, A.X., *See* Li, N.N., 15:700
Swaminathan, P.K., Semiclassical theory of polyatomic infrared Multiphoton Processes, phase 1. Appendices A through C. Technical report (Final), 15:1695 (R;US)
Swanson, D.A., Some volcanologic aspects of Columbia River basalt volcanism relevant to the extinction controversy, 15:1533 (RA;US)
Swanson, R.B., *See* Zarling, J.P., 15:1414, 15:1415
Swanson, T.D., Workshop on Two-Phase Fluid Behavior in a Space Environment, 15:1056 (R;US)
Swartzlander, A.B., *See* Longrigg, P., 15:259
Sweeney, D.W, *See* Ochoa, E., 15:1080
Sweeney, J.J., Pyrolysis kinetics applied to prediction of oil generation in the Maracaibo Basin, Venezuela, 15:107 (R;US)
Sweet, R.M., Synchrotron radiation as a tool for study of biolcgical structure, 15:1395 (R;US)
[Biological applications of synchrotron radiation]: Foreign trip report, August 13–19, 1989, 15:1427 (R;US)
Swegle, J.W., Acceleration instability in elastic-plastic solids. I. Numerical simulations of plate acceleration, 15:1860 (J;US)
See Robinson, A.C., 15:1859
Swenson, L.D., Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)
Swette, L., Oxygen electrodes for rechargeable alkaline fuel cells, 15:663 (RA;US)
Swift, W.M., SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)
Sylvain, C., Leak suppression at steam generator man-, hand-, and eyeholes, 15:370 (J;US)
Sype, T.T., *See* Camp, A.L., 15:520
Syriopoulou, D., *See* Koussis, A.D., 15:1331
Szabo, M.F., *See* Apel, M.L., 15:721
Szeles, M.S.-M.F., *See* Duarte, C.L., 15:931
Szoke, A., *See* Perry, M.D., 15:1705
Szreders, B.E, *See* Brian, R., 15:672
Szuszczewicz, E.P., Coupling and controls of ionospheric processes in the composite solar-terrestrial system, 15:1637 (RA;BR)

T

Taber, J.J., *See* Heller, J.P., 15:53
Taft, S.O., *See* Burnham, A.K., 15:631
Taivassalo, V., *See* Hautojaervi, A., 15:179
Tajima, T., *See* Kurki-Suonio, T., 15:1917
Takahashi, H., *See* Fagundes, P.R., 15:1653
See Gobbi, D., 15:1655
See Sobral, J.H.A., 15:1668
Takahashi, Hiroshi, [Production and use of energy from nuclear reactions]: Foreign trip report, July 2–8, 1989, 15:334 (R;US)
Takahashi, Masanori, Evaporation characteristics of a reprocessing plant HLLW concentrator, 15:187 (J;US)
Takaoka, N., *See* Miura, Y., 15:1504
Takashiba, Osamu, *See* Jojo, Kazumasa, 15:301
Takeda, Yukihiro, *See* Fukuda, Hideo, 15:238
Takenaka, Kiyoshi, Multisolution load flow and index of voltage stability, 15:317 (R;JP;In Japanese)
Takeuchi, K., Development and assessment of an AI expert system for the monitoring and diagnosis of nuclear power plants, 15:455 (J;US)
Takigawa, Kiyoshi, *See* Fukuda, Hideo, 15:238
Taleyarkhan, R.P., Large break loss-of-coolant accident analyses for the high flux isotope reactor, 15:483 (R;US)
Tallant, D.R., Boron carbide structure by Raman spectroscopy, 15:866 (J;US)
Tallman, A.M., Natural phenomena analyses, Hanford Site, Washington, 15:1319 (R;US)
Talmadge, C., *See* Trampetic, J., 15:1758
Talukdar, S., *See* Sweeney, J.J., 15:107
Tame, N.R., *See* Teixeira, W., 15:1470
Tamura, Yasuo, *See* Taniguchi, Haruhito, 15:313
Tan, M.J., An experimental study of two-phase natural circulation in an adiabatic flow loop, 15:428 (BA;US)
Tanabe, Kazuo, Optical acoustic sensor using optical fiber, 15:1213 (R;JP;In Japanese)
Tanaka, Kazuyuki, *See* Koso, Seiichi, 15:319
Tang, F., *See* Tsurutani, B.T., 15:1639
Tang, J., *See* Trost, L.H., 15:1728

Tang, X., Dynamics of resonances rapidly shifting under short laser pulses, 15:1704 (J;US)
Tani, B.S., *See* Bates, J.K., 15:958
Tani, Tatsuo, Evaluation of photovoltaic modules in downtown of Tokyo, 15:271 (RA;JP;In Japanese)
See Fukuda, Hideo, 15:238
Taniguchi, Haruhito, Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator, 15:313 (R;JP;In Japanese)
See Ichikawa, Tatsumi, 15:320
See Jojo, Kazumasa, 15:301
Tanner, J.E., The effect of gender and remainder on effective dose equivalent, 15:1843 (J;US)
See Spriggs, G.D., 15:120, 15:457
Tanzer, H.J., High capacity demonstration of honeycomb panel heat pipes. Final technical report, 15:1052 (R;US)
Tarascon, J.M., *See* Jorgensen, J.D., 15:1869
Targovnik, H., *See* Rubio, M.C., 15:1398
Tarver, C.M., Using small scale tests to estimate the failure diameter of a propellant, 15:230 (R;US)
Tassinari, C.C.G., Age of the rocks and the metamorphic episodes from the Southeastern of Sao Paulo state, 15:1469 (R;BR;In Portuguese)
Taub, H., *See* Larese, J.Z., 15:913
Tavino, R.R., *See* Blum, S., 15:685
Taya, M., *See* Jenkins, M.G., 15:824
Taylor, A.G., *See* Kamegai, M., 15:837
Taylor, G.E. Jr., *See* Lindberg, S.E., 15:1262
Taylor, P.N., *See* Tassinari, C.C.G., 15:1469
Taylor, P.R., *See* Bauschlicher, C.W. Jr., 15:944, 15:945
Taylor, S.E., Effect of applied environmental stress on growth, photosynthesis, carbon allocation, and hydrocarbon production in Euphorbia lathyris, 15:226 (RA;US)
Taylor, T.R., Quenching the cosmological constant, 15:1610 (J;NL)
Teats, F.G., *See* Swift, W.M., 15:29
Tebbe, F.N., *See* Hu, B., 15:1857
Techimirev, V.M., *See* Korobeinikov, V.G., 15:1898
Teeter, A.M., New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
Teixeira, N. R., *See* Fagundes, P.R., 15:1653
Teixeira, W., K-Ar geochronology of mafic dyke swarms from the meridional part of Sao Francisco craton and implications on tectonic context, 15:1470 (R;BR;In Portuguese)
Telschow, K.L., *See* Debsikdar, J.C., 15:825
Tennery, V.J., [Application of electron microscopy for the analysis of the mechanical behavior of advanced ceramics]: Foreign trip report, June 3, 1988–June 13, 1988, 15:831 (R;US)
[Ceramic powder characterization]: Foreign trip report, October 7–14, 1988, 15:834 (R;US)
Tentindo-Repond, S., *See* Geesaman, D.F., 15:1134
Terawaki, Toshinobu, Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)
Terrell, M.S., Integrating radwaste treatment equipment into radwaste processing systems, 15:474 (J;US)
Tesini, A., Tritium contamination studies involving test materials and jet remote handling tools, 15:1962 (R;US)
Tew, R.C., *See* Ibrahim, M.B., 15:1054
Thalmann, I., Non-muscle contractile proteins in the organ of corti, 15:1377 (J;US)
Thalmann, R., *See* Thalmann, I., 15:1377
Thieme, C., *See* Chen, M., 15:1883
Thomas, A., Biofouling and corrosion research for marine heat exchangers, 15:279 (R;US)
Thomas, E., Mass extinctions in the deep sea, 15:1529 (RA;US)
Thomas, L.E., Microstructural examination of oxidized spent PWR fuel by transmission electron microscopy, 15:375 (J;NL)
Thomas, M.M., A program for calculating and plotting soft x-ray optical interaction coefficients for molecules, 15:1215 (R;US)
Thomas, R.D., *See* Bailey, S.G., 15:251
Thomas, T.R., *See* Del Debbio, J.A., 15:175
Thome, F., High-temperature electronics available now and plans for the future, 15:1076 (R;US)
Thome, R.J., *See* Herring, J.S., 15:1934
Thompson, E.R., Composite material systems for high temperature applications, 15:868 (RA;US)
Thompson, H.L. Jr., The role of the Nuclear Regulatory Commission in the management of nuclear waste, 15:189 (J;US)
Thompson, J.D., *See* Hundley, M.F., 15:861
Thompson, M.C., *See* Bennett, G.A., 15:1073
Thompson, S.L., Acute effects of a large bolide impact simulated by a global atmospheric circulation model, 15:1530 (RA;US)
Thompson, W.R., *See* Khare, B.N., 15:1609
Thullen, P., *See* Hammer, C.F., 15:1956
Thun, M.J., Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Thun, R., *See* Kilpelaeinen, H., 15:16
Thurston, T.R., Neutron scattering study of the magnetic excitations in metallic and superconducting $La_{2-x}Sr_xCuO_{4-y}$, 15:856 (J;US)
See Yamada, K., 15:855
Tian Baosheng, *See* Zhang Qingxuan, 15:919
Tian, D., *See* Li, H., 15:815
Tierney, J.W., *See* Holder, G.D., 15:5
Tilbrook, R.W., Comparison of the effect of insulating blockages on metal and oxide fuel elements, 15:517 (J;US)
Tilley, D.R., *See* Riley, J.C., 15:1784
Timmons, M.L., *See* Ahrenkiel, R.K., 15:905
Timofeev, V.B., *See* Bazhenov, A.V., 15:850
Titran, R.H., *See* Hebsur, M.G., 15:793
Tobin, K.W., *See* Muhs, J.D., 15:871
Tobin, S.P., *See* Ahrenkiel, R.K., 15:906, 15:907
Todd, D.E., *See* Johnson, D.W., 15:1306
Toedter, J., *See* Mahrenholtz, O., 15:741
Toffer, H., Corrections for graphite-induced problems in N reactor, 15:528 (J;US)
Guidance on the use of fixed neutron absorbers, 15:452 (R;US)
Tollin, G., *See* Senthilathipan, V., 15:1379
Tolliver, J.S., *See* Lyon, J.F., 15:1013
Tomasko, D., *See* Fingleton, D.J., 15:1317
Tomita, Seietsu, Characteristics of electromagnetic wave forms with lightning in winter season, 15:1235 (R;JP;In Japanese)
Tonn, B., Elicitation of natural language representations of uncertainty using computer technology, 15:1987 (R;US)
Toomre, J., *See* Merryfield, W.J., 15:1551
Torbin, R.N., State-of-the-art interior piping systems applications: Single-family buildings. Final report, January 1985-December 1986, 15:100 (R;US)
Torre, A. de la, Absolute stability in a low density electron heat conducting plasma in strong magnetic fields, 15:1900 (RA;BR)
Tortorelli, P.F., [Lithium and lead-lithium corrosion and chemistry]: Foreign trip report, September 18–26, 1989, 15:793 (R;US)
Toth, K.S., *See* Moltz, D.M., 15:1780
Townsend, L.W., *See* Wilson, J.W., 15:1740
Tracy, D.B., Improvements in fabrication of metallic fuels, 15:113 (R;US)
Tracy, J.G., *See* Caudill, H.H., 15:917
Trampetic, J., Detecting hyperphotons in kaon decays, 15:1758 (J;US)
Tran, T.M., *See* Kuefner, K., 15:1941
Tranquada, J.M., Neutron scattering studies of magnetic correlations in the layered cuprates, 15:1868 (R;US)
Neutron scattering study of magnetic excitations in $YBa_2Cu_3O_{6+x}$, 15:852 (J;US)
Trautmann, W., *See* Pochodzalla, J., 15:1801
Travis, C., *See* Tonn, B., 15:1987
Travis, C.C., *See* Chidambariah, Venkatesh, 15:732
Trebes, J.E., *See* London, R.A., 15:1219
Tredous, M., Geochemical comparison of K-T boundaries from the Northern and Southern Hemispheres, 15:1531 (RA;US)
Treusch, J., *See* Wenzl, H., 15:1781
Trevino, S.F., *See* Lynn, J.W., 15:860
Triay, I., *See* Meijaer, A., 15:155
Triolo, J.J., Returned Solar Max hardware degradation study results, 15:784 (RA;US)

Trivedi, N.B., Geomagnetic research in Brazil, 15:1638 (RA;BR)
Trivelpiece, A.W., Environmental boundaries to energy development, 15:616 (R;US)
Trocciola, J.C., *See* Meyer, A.P., 15:669
Trockel, W., *See* Pochodzalla, J., 15:1801
Trocki, L.K., An economic prefeasibility study of geothermal energy development at Platanares, Honduras, 15:293 (R;US)
Trost, L.H., New measurement of the production polarization and magnetic moment of the Ξ^- hyperon, 15:1728 (J;US)
Truesdell, A.H., *See* Aunzo, Z., 15:297
Truhlar, D.G., *See* Hancock, G.C., 15:952
Trujillo, P.E. Jr., *See* Grigsby, C.O., 15:294
Trujillo, V., Characterization of compliant thermal conductive tungsten material for thermionic element application, 15:656 (BA;US)
Tryk, D., *See* Prakash, J., 15:662
Tsai, K.J., The electrochemical generation of useful chemical species from lunar materials, 15:555 (RA;US)
Tsai, S.P., *See* Coleman, R.D., 15:698
Tsai, T.S., *See* Coleman, R.D., 15:698
Tsukamoto, S., *See* Oh, J.E., 15:885, 15:886
Tsuo, Y.S., Recent results on ion-beam hydrogenation of amorphous silicon, 15:900 (BA;US)
Tsurutani, B.T., Interplanetary magnetic phenomena and processes and the resultant control of geomagnetic activity at earth, 15:1639 (RA;BR)
Tumeo, M.A., *See* Zarling, J.P., 15:1414, 15:1415
Turco, R.F., Contribution of subsoil and aquifer microorganisms to ground-water quality. Technical report, 1 July 1988-30 June 1989. (Final), 15:1334 (R;US)
Turek, P., CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, 15:1147 (R;DE;In German)
Turner, D.C., *See* Lewis, R.N.A.H., 15:1407
Turner, J.E., *See* Wright, H.A., 15:1423
Turner, J.W., *See* Mansour, M.M., 15:1741
Turner, M.S., *See* Stebbins, A., 15:1570
Turner, R.E., *See* Drake, R.P., 15:1916
Turner, W.C., *See* Avery, R.K., 15:1129
Turtelli Junior, A., *See* Martin, I.M., 15:1672
See Van, N.A.B., 15:1674
Turuc, S., *See* Buerger, W., 15:1099
Tveten, U., Economic consequences of the Chernobyl accident in Norway in 1986 and 1987, 15:535 (J;US)
Twist, D., *See* Elston, W.E., 15:1479
Tze, Chia-Hsiung, Linking the Gauss-Bonnet-Chern theorem, essential HOPF maps and membrane solitons with exotic spin and statistics, 15:1763 (R;US)

U

Uhrig, R.E., *See* Qualls, A.L., 15:420
Uldrich, E.D., The evolution of seismic design criteria at the Idaho Chemical Processing Plant, 15:1320 (R;US)
Ullman, J.E., Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Ulwick, J.C., Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)
Umar, A.S., *See* Dean, D.J., 15:1822
Umminger, K., PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report, 15:354 (R;DE;In German)
Unterricker, S., *See* Degering, D., 15:1545
See Kim, J.H., 15:1187
Upadhyaya, B.R., *See* Gloeckler, O., 15:518
See Qualls, A.L., 15:420
Utell, M.J., *See* Morrow, P.E., 15:1461

V

Vaishnene, L.A., *See* Andronenko, L.N., 15:1183
Vaknin, D., *See* Pei, S.Y., 15:821
Valencia, G., *See* Marciano, W., 15:1759
Valeo, E.J., *See* Susskind, S.M., 15:1696
Valk, P.E., *See* Lo, E.H., 15:1435
Vallario, E.J., *See* Carlson, R.D., 15:1839
Vallejos, C., *See* Sweeney, J.J., 15:107
Valles, J.L., *See* Nielaba, P., 15:1856
Van Brunt, R.J., Research for electric energy systems: An annual report, 15:331 (R;US)
Van Den Avyle, J.A., *See* Scully, J.R., 15:799
Van Dyke, P., *See* Burnham, A.K., 15:631
Van Lyssel, T., *See* Rinard, P.M., 15:151, 15:215
Van Miegroet, H., *See* Lindberg, S.E., 15:1262
Van Orden, J.W., *See* Chinn, C.R., 15:1820
Van Swam, L.F., *See* Howe, T.M., 15:344
Van Tuyle, G.J., *See* Slovik, G.C., 15:516
Van Voorhees, E., *See* Singh, J.P., 15:848
Van, N.A.B., Observations of high-energy electrons in the stratosphere, 15:1674 (RA;BR)
Short period variation of cosmic ray intensity observed in the stratosphere, 15:1673 (RA;BR)
See Martin, I.M., 15:1672
VanderLaan, J.F., DIII-D power supply fault system, 15:1913 (J;US)
Vandervoort, K.G., *See* Dabrowski, B., 15:823
See Welp, U., 15:864
Vanek, M.D., *See* Schneider, M., 15:1035
Vanfleet, H.B., *See* Dabrowski, B., 15:823
Vanwanderham, M.C., *See* Farmer, T.E., 15:1082
Varadarajan, V., Control of helium accumulation by fishbones, 15:1921 (R;US)
Varandas, A.J.C., *See* Hancock, G.C., 15:952
Vargo, M.F., Distributed control system-based process simulation: Revision 1, 15:177 (R;US)
Varma, R., Electrodeposition of cadmium from aqueous fluoborate electrolytes, 15:801 (B;US)
Varner, R.L. Jr., [Data acquisition and analysis of data from highly segmented Ge gamma-ray detectors]: Foreign trip report, September 3, 1989–September 30, 1989, 15:1175 (R;US)
Vary, J.P., *See* Benesh, C.J., 15:1819
Vasconcellos, L.M.H., Concentrations of ^{226}Ra and ^{210}Pb in agricultural products surrounding the first brazilian mine and mill in Pocos de Caldas, MG, 15:200 (R;BR;In Portuguese)
Vasquez, G.J., Study on atmospheric spectroscopy, 15:1675 (RA;BR)
Vaughn, R.L., Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989, 15:548 (R;US)
Vautherin, D., *See* Bernard, V., 15:1756
Vawter, G.A., Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs, 15:1040 (J;US)
See Ashby, C.I.H., 15:909
Veach, A.M., *See* Caudill, H.H., 15:917
Vega, P., *See* Gomberoff, L., 15:1682, 15:1899
Veklerov, E., *See* Llacer, J., 15:1214
Veleckis, E., *See* Bates, J.K., 15:958
Veliz, O., *See* Kitamura, T.-J., 15:1631
Veneziano, G., *See* Taylor, T.R., 15:1610
Vento, D.M., Solid surface combustion space shuttle experiment hardware description and ground-based test results, 15:974 (R;US)
Venturino, A., *See* Rivera, E.S., 15:1399
Verdera, E.S., *See* Arguelles, M.G., 15:965
Verghese, K., *See* Gardner, R.P., 15:1220
Verhagen, B.T., *See* Tredous, M., 15:1531
Verhoeven, J.D., *See* Ullman, J.E., 15:841
Verno, G.A., *See* Combs, R.T., 15:9
Vernon, S.M., *See* Ahrenkiel, R.K., 15:906, 15:907
Verzwyvelt, S.A., *See* Lim, H.S., 15:558
Vianna, E.C.M., *See* Vasconcellos, L.M.H., 15:200
Vicente-Vacas, M., *See* Oset, E., 15:1738
Vidal, M., *See* Geesaman, D.F., 15:1134
Vijjeswarapu, W., *See* Clifford, D., 15:1346
Vinokur, M., Flux Jacobian matrices and generaled Roe average for an equilibrium real gas, 15:1717 (R;US)
Viola, V.E. Jr., *See* Skulski, W., 15:1821
Virshup, G.F., *See* Gee, J.M., 15:289
See Kaminar, N.R., 15:291

See MacMillan, H.F., 15:257, 15:261
See Werthen, J.G., 15:288
Visco, S.J., Novel nitrogen-based organosulfur electrodes for advanced intermediate temperature batteries, 15:553 (RA;US)
Vishniac, E.T., *See* Ryu, D., 15:1572
Vitek, J.M., [Welding and melting by electron and laser beams]: Foreign trip report, September 11–October 2, 1988, 15:788 (R;US)
Vitton, M., *See* Millot, J.P., 15:368
Voigt, J.A, *See* Bunker, B.C., 15:1016
Voilleque, P., *See* Beahm, E.C., 15:356
Volk, T., *See* Rampino, M.R., 15:1515
Volkovskaya, E.I., Kinetics of samarium solvent extraction and stripping in systems with DiOMPh, 15:941 (RA;SU;In Russian)
von Halle, A., *See* Kamperschroer, J.H., 15:1970
Vonbradke, M.L, *See* Krause, S., 15:547
Vorbach, J., *See* Berlow, J.R., 15:1351
Votava, M., *See* Dorries, T., 15:1138
See Pordes, R., 15:1133
Voth, M.H., An instructional hydraulic analog of fission product poisoning dynamics, 15:430 (J;US)
Vozzo, S.F., Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)
Vyas, B., High energy density lithium niobium triselenide cells, 15:573 (BA;US)

W

Wachtel, J.M., Rf stability, control and bunch lengthening in electron synchrotron storage rings, 15:1101 (R;US)
Wachter, J.P., *See* Schuster, J.R., 15:990
Waddoups, I.G., Application of item and personnel tracking to materials control, 15:216 (R;US)
Wagener, T.J., Photoemission and inverse-photoemission studies of $Ba_{1-x}K_xBiO_{3-y}$, 15:854 (J;US)
Wagner, J.A., *See* Horvath, S.M., 15:1274
Wagner, R.G., *See* Gabutti, A., 15:1161
Wagner, S., *See* Shen, D.S., 15:902
Wagner, W., Separation of outer-shell satellite X-ray lines at sources of highly ionized atoms, 15:1193 (RA;DD)
Wahl, A. K., Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989, 15:880 (R;US)
Wahlstedt, D.A., *See* Rasmussen, R.W., 15:102
Wakamatsu, Yoshio, *See* Masuya, Goro, 15:695
Wakeman, B.H., *See* Hostick, C.J., 15:207
See Lavender, J.C., 15:206
Walker, D.S., Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Wallace, M., Oil import taxes and national security, 15:637 (RA;US)
Wallace, W., Advances in material/cell/submodule research in the DOE/SERI amorphous silicon research project, 15:258 (BA;US)
Walls, S.J., *See* Glazbrook, D.J., 15:211
Walsh, F., Low-temperature performance of a power-pack for a 2-watt ELT, 15:587 (BA;US)
Walsh, T.F., *See* Born, K.D., 15:1772
Walther, S.R., Development of a Li^- ion source, 15:1914 (J;US)
Walton, O.R., *See* Kamegai, M., 15:837
Walz, H.V., *See* Agostini, R.C., 15:1014
Wang, C.K., A neutron spectrometer for neutron energies between 1 eV and 10 keV, 15:1202 (J;US)
Wang, L.K., Advanced precoat filtration and competitive processes for water purification. Technical report, 15:1333 (R;US)
Wang, M.H.S., *See* Wang, L.K., 15:1333
Wang, S.C.P., *See* Collins, C., 15:437
Wang, T.K., *See* Chen, C.C., 15:537
Wang, X.-J, *See* Gaspard, P., 15:1716
Wang, X.W., Hydrogen interactions in PdH_n ($1 \leq n \leq 4$), 15:867 (J;US)
Wangen, L.E., *See* Peterson, E.J., 15:877
Wanlass, M.W., *See* Yahia, A.H., 15:267
Warburton, E.K., *See* Hill, J.C., 15:1789
Ward, B.F.L., Beam-polarization phenomena in high-energy e^+e^- collider physics, 15:1748 (J;US)
Ward, D.J., *See* Bathke, C.G., 15:1901
Ward, L.W., *See* Nelson, W.R., 15:511
Ward, P.D., Macrofossil extinction patterns at Bay of Biscay Cretaceous-Tertiary boundary sections, 15:1534 (RA;US)
Ward, T.E., Genetic manipulation of acidophilic bacteria, 15:7 (R;US)
See Olin, R.C., 15:1267
Ware, A.G., *See* Caffrey, A.J., 15:1884
Warford, J.J., *See* Schramm, G., 15:625
Wark, J.S., Subnanosecond x-ray diffraction from laser-shocked crystals, 15:915 (J;US)
Warnes, W.H., Perturbed angular correlation study of impurity interactions in a cubic host metal: Hf in Nb, 15:807 (J;US)
Warren-Hicks, W., Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
Warshawsky, A.S., Nuclear/conventional interaction in battlefield operations, 15:1232 (R;US)
Was, Z., *See* Colas, P., 15:1739
Wasan, D.T., Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report, 1987–1988, 15:51 (R;US)
Washburn, J., *See* Jou, C.J., 15:843
Washio, T., Development and experimental demonstration of a noise-reduction technique for a nonlinear dynamic system, 15:464 (J;US)
Washio, Takashi, *See* Bernard, J.A., 15:469
Wasserman, H.J., *See* Burns, P.J., 15:1988
Watkins, C.S., *See* Ward, T.E., 15:7
Watkins, D., Canadian solid polymer fuel cell development, 15:667 (BA;US)
Watson, G.M., *See* Bartynski, R.A., 15:811
Watson, J.S., Use of bioadsorbents for removing dissolved metals from dilute solutions, 15:181 (B;US)
Watson, R.E., Exchange coupling in metals as understood then and now, 15:760 (R;US)
Watson, S., *See* Levi, M., 15:1131
Watts, R.J., *See* Aminian, K., 15:55
Wdowiak, P., *See* Wdowiak, T.J., 15:1535
Wdowiak, T.J., Heavy metal toxicity as a kill mechanism in impact caused mass extinctions, 15:1535 (RA;US)
Weatherford, C.A., *See* Jones, H.W., 15:1691
Weaver, H.T., *See* Lott, J.A., 15:1077
Weaver, J.H., *See* Wagener, T.J., 15:854
Webb, M., *See* Lindsey, G., 15:717
Webb, S.W., Calculation of natural convection boundary layer profiles using the local similarity approach including turbulence and mixed convection, 15:46 (R;US)
Weber, C.I., Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)
Weber, H., *See* Petersen, G., 15:1258
Weber, L.A., Vapor pressures and gas-phase PVT data for 1,1,1,2-tetrafluoroethane, 15:950 (J;US)
Wehrle, R., *See* Kramer, S.L., 15:1109
Wei, Y.H., *See* Gaudiot, J.L., 15:2007
Weisbin, C.R., *See* Goldstein, M., 15:1990
Weiser, P., *See* Nordmann, R., 15:989
Weiss, A.J., Transactions of the seventeenth water reactor safety information meeting, 15:494 (R;US)
Weiss, B.H., What was learned in developing the 1987 Zion Federal Field Exercise that can be used in planning other emergency response exercises?, 15:482 (R;US)
Weissman, P.R., Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)
See Covey, C., 15:1238
Weisz, S.G., *See* Gianibelli, J.C., 15:1641
Weller, A.E., Assessment of technology for self-powered gas appliances: A GATC (Gas Appliance Technology Center) task report, July 1988-January 1989, 15:103 (R;US)
Weller, H.R., *See* Riley, J.C., 15:1784
Weller, M., Acoustical and dielectric loss in natural macromolecular solids, 15:22 (BA;NL)
Wellman, G.W., *See* Barker, L.M., 15:996
Wells, B.O., Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)
See Lindberg, P.A.P., 15:847, 15:857

See Shen, Z.X., 15:1873
Wells, J.S., *See* Schneider, M., 15:1035
Welp, U., Angular dependence of the upper critical field of $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:864 (J;US)
See Shi, D., 15:862
Welsh, J.D., *See* Lipton, R.J., 15:2006
Wen, L., *See* Mon, G., 15:901
Wen, T., Environmental measurements in the Beaufort Sea, Spring 1988. Technical report, 15:1322 (R;US)
Wendebaum, G., *See* Degering, D., 15:1545
Wendler, E., *See* Wesch, W., 15:1854, 15:1855
Wendt, J.O.L., *See* Linak, W.P., 15:736
Weng, W.T., [Progresses and status of the AGS booster project]: Foreign trip report, August 9, 1989–August 27, 1989, 15:1093 (R;US)
Wenzl, H., KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)
Werley, K.A., *See* Hsiao Mingyuan, 15:1911
Werme, L.O., *See* Grambow, B., 15:183
Werner, K.H., *See* Kaltenhaeuser, A., 15:1419
Wernick, E., *See* Kawashita, K., 15:1471
Wernick, J.H., *See* Wertheim, G.K., 15:813
Wert, C., *See* Weller, M., 15:22
Wertheim, G.K., Charge transfer in intermetallics: $HfPt_3$, 15:813 (J;US)
Wertheimer, S., *See* Baird, B., 15:2001
Werthen, J.G., Recent advances in high-efficiency InGaAs concentrator cells, 15:288 (BA;US)
See MacMillan, H.F., 15:257
Wesch, W., Defects in laser annealed ion implanted GaAs layers, 15:1855 (RA;DD)
RBS investigations of defects in weakly damaged GaAs, 15:1854 (RA;DD)
Wesely, M.L., *See* Doran, J.C., 15:1246
Wesley, D.A., *See* Short, S.A., 15:506
West, G.B., Dark matter and the solar neutrino problem: Can particle physics provide a single solution, 15:1568 (R;US)
West, J.T., SABRINA - an interactive geometry modeler for MCNP, 15:445 (J;US)
Westbrook, E.M., *See* Spangler, B.D., 15:1408
Westervelt, R.T., *See* Howell, J.A., 15:1095
Wetch, J.R., Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 1. Objectives, summary results and introduction. Final report, 15:397 (R;US)
Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 4: Concepts selection, conceptual designs, recommendations, 15:398 (R;US)
Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 3, technologies 2: Power conversion. Final report, 15:399 (R;US)
Whaley, R.D. Jr., *See* Kurtz, S.R., 15:255
Whang, M.H., Self-focusing of laser beams in magnetized relativistic electron beams, 15:1909 (BA;US)
Whatley, W.J., *See* Zwan, A.D., 15:755
Wheaton, J.H., ICRF Faraday shield plasma sheath models: Low and high conductivity limits, 15:1924 (R;US)
See Ryan, P.M., 15:1923
White, A.M., *See* Kubic, W.L. Jr., 15:480
White, A.R., Confinement and the Pomeron, 15:1731 (R;US)
White, D.L., *See* Schweitzer, M., 15:653
White, L.S., *See* Li, N.N., 15:700
White, P.S., *See* Bruhns, O.T., 15:771
Whitehead, E.E., United States military strategy in the Persian Gulf. Study project, 15:45 (R;US)
Whiteman, C.D., Deep valley radiation and surface energy budget microclimates. Part II: Energy Budget, 15:1245 (J;US)
Deep valley radiation and surface energy budget microclimates. Part I: Radiation, 15:1247 (J;US)
Whitlock, R.R., *See* Wark, J.S., 15:915
Whitson, J.C., *See* Peng, Y.K.M., 15:1888
Whitten, J.L., *See* Fischer, C.R., 15:814
Whittenberg, P., Alternative vehicle fuels, 15:600 (RA;US)
Local Government Operation, 15:628 (RA;US)
Whittenberg, P.L., Alternate vehicle fuels unit, 15:596 (RA;US)
Local Government Operations, 15:627 (RA;US)
Whittenburg, P., Alternative vehicle fuels unit, 15:597 (RA;US)
Whittenburg, P.L., Alternate vehicle fuels unit, 15:599 (RA;US)
Alternate vehicular fuels, 15:598 (RA;US)
Whittle, G.E., *See* Rayment, R., 15:673
Wicker, L.F., *See* Kszos, L.A., 15:1443
Wicks, F., A cost-effective and fuel-conserving nonelectric air conditioner that combines engine-driven compression and absorption cycles, 15:728 (J;US)
Wickstrom, I.H., *See* Baranoski, M.T., 15:86
Wiebe, L.I., Synthesis and properties of 1-(4-iodo-5nitroimidazolyl)-2-hydroxy-3 methoxypropane. A novel radiosensitizer for use as an hypoxic cell marker, 15:963 (RA;AR)
Wiebe, S.R., *See* Quigley, D.R., 15:21
Wight, R.R., *See* Miller, C.W., 15:526
Wightman, R.O., Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
Wignall, G.D., Isotope driven critical scattering and phase separation in mixtures of deuterated and protonated polymers, 15:874 (R;US)
Wilde, P., *See* Berry, W. B. N., 15:1476
Wilds, W.A., *See* Reass, W.A., 15:1953
Wilen, C., *See* Kilpelaeinen, H., 15:16
Wiley, J.C., Transport modeling and advanced computer techniques, 15:1893 (R;US)
Wilford, C.F., Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties, 15:770 (R;GB)
Wilhelmy, J.B., *See* Fowler, M.M., 15:1207
Wilkins, R.W., The design of the CPRF [Confinement Physics Research Facility] control system, 15:1957 (R;US)
Wilkinson, D.C., Trends in environmentally induced spacecraft anomalies, 15:1687 (RA;BR)
Will, E., Majority coincidence unit, 15:1199 (RA;DD)
See Kleinwaechter, P., 15:1178
See Winter, G., 15:1189
Willenbrock, S., *See* Marciano, W., 15:1759
Williams, C.H., Electricity management, 15:630 (RA;US)
Energy purchasing alternative: Chicago reviews its position, 15:641 (RA;US)
Williams, E.A., *See* Drake, R.P., 15:1916
Williams, J.B., Composition of phytoplankton communities and their contribution to secondary productivity in Carolina Bays on the Savannah River Plant: Year one report, 15:1323 (R;US)
Williams, J.G., *See* Micklich, B.J., 15:545
See Stubbins, J.F., 15:453
Williams, L.G., *See* Zucconi, L., 15:1998
Williams, M.D., *See* Kwon, J.H., 15:329
See Zapata, L.E., 15:1031
Williams, R.S., *See* Hsu, L., 15:751
Williamson, S.E., *See* Papanicolas, C.N., 15:1205
Williamson, T.G., *See* Hendrixson, E.S., 15:542
Willis, A.J., *See* Pettifor, D.G., 15:787
Willms, R.S., Fusion fuel purification during the Tritium Systems Test Assembly 3-week loop experiment, 15:1959 (R;US)
See Enoeda, M., 15:1950
Wilmarth, P.A., *See* Moltz, D.M., 15:1780
Wilson, E.O., Biodiversity, 15:1392 (R;US)
Wilson, J.G., *See* Awaluddin, A., 15:1396
See Maddalena, D.J., 15:1400
Wilson, J.W., BRYNTRN: A baryon transport model, 15:1740 (R;US)
Wilson, W.B., Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV, 15:1806 (R;US)
See Brady, M.C., 15:541
Wilt, D.M., *See* Bailey, S.G., 15:251
Winans, R.E., Chemical structures in eight US premium coals: The nature of the heteroatoms, 15:19 (R;US)
See Anderson, K.B., 15:18
See Neill, P.H., 15:17
Winefordner, J.D., Development of laser excited atomic fluorescence and ionization spectrometric methods: Progress report, January 1, 1989–October 1, 1989, 15:918 (R;US)
Winger, J.A., *See* Hill, J.C., 15:1789
Winick, H., *See* Kramer, S.L., 15:1141

Winkel, R.J., Soviet strategic nuclear doctrine under Gorbachev. Study project, 15:1225 (R;US)
Winsley, K., *See* Singh, J.P., 15:848
Winslow, C., Space station freedom solar array design development, 15:247 (R;US)
Winston, R., *See* Trost, L.H., 15:1728
Winter, G., Construction of a plunger for coincidence experiments, 15:1179 (RA;DD)
Suppression of low-multiplicity γ-radiation in plunger experiments by means of coincidence technique, 15:1189 (RA;DD)
Winter, J.M., CSTI High Capacity Power, 15:401 (R;US)
Winter, M., *See* Buschmann, H., 15:1421
Wirkner-Bott, I., *See* Behrens, U., 15:481
Wise, M.L., *See* Rensberger, K.J., 15:978
Wise, S.W., Evidence of volcanic ash at a K-T boundary section: Ocean drilling program hole 690 C, Maud Rise, Weddell Sea off East Antarctica, 15:1537 (RA;US)
Withers, R.S., *See* Dilorio, M.S., 15:982
Witherspoon, P.A., *See* Aunzo, Z., 15:297
Witt, G., On the excitation mechanism of oxygen-related emissions in the airglow and aurora, 15:1640 (RA;BR)
Wohlfahrt-Mehrens, M., Layer formation of lithium and its implications for secondary Li-batteries, 15:566 (BA;US)
Wohlfarth, D., *See* Manfrass, P., 15:1184, 15:1405
Wohn, F.K., *See* Hill, J.C., 15:1789
Wolanczyk, S.M., Development of sodium-sulfur batteries for space power applications, 15:585 (BA;US)
Wolbach, W.S., Darkness after the K-T impact: Effects of soot, 15:1538 (RA;US)
Wolery, T.J., Activity coefficients in aqueous salt solutions: 2, Hydration theory equations, 15:1544 (R;US)
Wolf, F., Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)
Wolfe, B.A., *See* Swenson, L.D., 15:173
Wolff, W.F., *See* Gant, K.S., 15:1422
Wolfram, J.H., *See* Christensen, A.B., 15:124
Wolsky, A.M., Advances in applied superconductivity, 15:645 (RA;US)
Wonder, E.F., *See* Moran, B.W., 15:213
Wong, C.P.-C., *See* Herring, J.S., 15:1935
Wong, W., *See* Loer, S., 15:1130
Wood, S.A., *See* Papanicolas, C.N., 15:1205
Woodland, A.B., *See* Bates, J.K., 15:872
Woodley, R.E., *See* Thomas, L.E., 15:375
Woodruff, G.L., *See* Kumar, A., 15:1975
Woodruff, K.H., *See* Lo, E.H., 15:1435
Woodward, J, Recovery and reuse of cellulase catalyst in an exzymatic cellulose hydrolysis process, 15:233 (P;US)
Workman, W.G., *See* Zarling, J.P., 15:1414, 15:1415
Wright, C.W., *See* Bailey, S.A., 15:1172
Wright, H.A., Physical and chemical interactions in irradiated water containing DNA, 15:1423 (R;US)
Wright, I.G., A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)
Wright, T., *See* Hu, P.S., 15:1466
Wrighton, M.S., *See* Chen, M., 15:1883
Wu, H., *See* Shinar, R., 15:951
Wu, M.K., Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report, 15:879 (R;US)
Wu, S.C., *See* Li, H., 15:815

X

Xia, Yun ju, *See* Neill, P.H., 15:17
Xu, Y., *See* Tsuo, Y.S., 15:900

Y

Yager, R.E., Environmental monitoring annual report for the Tumulus Disposal Demonstration Project: Fiscal year 1988, 15:164 (R;US)
Yahia, A.H., Modeling and simulation of InP homojunction solar cells, 15:267 (BA;US)
Yamada, K., Spin dynamics in the two-dimensional quantum antiferromagnet La_2CuO_4, 15:855 (J;US)
See Thurston, T.R., 15:856
Yamada, Masaru, *See* Jojo, Kazumasa, 15:301
Yamaura, M., Thorium determination by X-ray Fluorescence Spectrometry in simulated thorex process solutions, 15:925 (R;BR;In Portuguese)
Yamazaki, Akio, The GTP binding protein-dependent activation and deactivation of cGMP phosphodiesterase in rod photoreceptors, 15:1373 (R;US)
Yamazaki, Y., *See* Stolterfoht, N., 15:1785
Yambert, M.W., *See* Chidambariah, Venkatesh, 15:732
Yang, Den-Mei, *See* Yang, Wen K., 15:1368
Yang, W., Block Lanczos approach combined with matrix continued fraction for the *S*-matrix Kohn variational principle in quantum scattering, 15:954 (J;US)
Yang, Wen K., "Integrase" protein of murine leukemia viruses, 15:1368 (R;US)
Yankelvich, D., *See* Mortazavi, M.A., 15:912
Yasukawa, E.A., *See* Sime, D.G., 15:1601
Ye, D., *See* Ahmad, I., 15:1799
Yeager, E., *See* Prakash, J., 15:662
Yen, W.M., *See* Brundage, R.T., 15:903
Yokote, Mitsuhiro, A Japanese gadolinia fuel usage and demonstration program, 15:359 (J;US)
Yokoyama, Shigeru, Experimental study of direct lightning hits on power distribution lines, 15:315 (R;JP;In Japanese)
Yoo, M.H., Deformation twinning in ordered intermetallic compounds, 15:765 (R;US)
Yoon, M., *See* Kramer, S.L., 15:1109
York, J.W., *See* Caudill, H.H., 15:917
York, T.M., Plasma flow processes within magnetic nozzle configurations, 15:1002 (B;US)
Yoshimitsu, Tsukasa, Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
Young, M.F., Hydrogen generation during fuel/coolant interactions, 15:510 (J;US)
Young, P.G., Transport data libraries for incident proton and neutron energies to 100 MeV, 15:1776 (R;US)
See Wilson, W.B., 15:1806
Youngblood, E.L., Upgrade of the radioactive air emission systems at Oak Ridge National Laboratory, 15:159 (RA;US)
Youngdahl, C.A., *See* Balachandran, U., 15:822
Youngdahl, C.K., Approximate methods for dynamic plastic deformation of structures, 15:766 (R;US)
Yu, C., The effect of liner hydraulic conductivity on disposal cell performance, 15:188 (J;US)
Yu, J.K., *See* Chen, G.S., 15:443
Yuan, H.J., Proton mean-free path in nuclear matter and in finite nuclei, 15:1824 (J;US)
Yuan, T., *See* Ng, K., 15:1757
Yuan, Y.C., *See* Chen, S.Y., 15:527
See Yu, C., 15:188
Yusa, Hideo, *See* Takahashi, Masanori, 15:187

Z

Zabot, S., Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)
Zabriskie, J.M., *See* Caffrey, A.J., 15:1884
Zabunoglu, O.H., *See* Spinrad, B.I., 15:413
Zachos, C., Hamiltonian flows, Su(∞), SO(∞), USp(∞), and strings, 15:1762 (R;US)
Zachos, J.C., Cretaceous-Tertiary boundary marine extinction and global primary productivity collapse, 15:1539 (RA;US)
Zackro, W.C., *See* Johnson, R.W., 15:3

Zahnle, K., Impact production of NO and reduced species, 15:1540 (RA;US)
Zaman, A., *See* Marsaglia, G., 15:2003
Zambutti, C.J., *See* Sobral, J.H.A., 15:1669
Zamick, L., *See* Auerbach, N., 15:1813
See Zheng, D.C., 15:1817
Zamiutti, C.J., Thermospheric models: a short review, 15:1671 (RA;BR)
See Sobral, J.H.A., 15:1667, 15:1668
Zammerilli, A.M., A simulation study of horizontal, high-angle, and vertical wells in Eastern Devonian shale, 15:89 (BA;US)
Zapalac, G., *See* Trost, L.H., 15:1728
Zapata, L.E., Analysis of Nd3+:glass, solar-pumped, high-powr laser systems, 15:1031 (R;US)
Zarling, J.P., Alaskan Commodities Irradiation Project: An options analysis study, 15:1415 (R;US)
[Alaskan commodities irradiation project: An options analysis study]: Final technical report, 15:1414 (R;US)
Zavadil, K.R., Reactions at the interface between multi-component glasses and metallic lithium films, 15:805 (J;US)
Zavesky, R.J., *See* Vento, D.M., 15:974
Zehe, M.J., Acidic attack of perfluorinated alkyl ether lubricant molecules by metal oxide surfaces, 15:943 (R;US)
Zehner, D.M., [Geometrical structural properties in the selvedge region of surfaces of random alloys]: Foreign trip report, July 21–September 30, 1989, 15:794 (R;US)
See Bartynski, R.A., 15:811
Zeidman, B., *See* Smith, L.C., 15:1783
Zelie, M.A. van, Signature of the equatorial ring current in the ground level geomagnetic field within the southern polar cap, 15:1645 (RA;BR)
Zentler, J.M., *See* Avery, R.K., 15:1129
Zerwas, P.M., *See* Born, K.D., 15:1772
Zhang Jiajun, *See* Zhang Qingxuan, 15:919
Zhang Qingxuan, Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium, 15:919 (TG;US)
Zhang, J.G.J., Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)
Zhang, Q.M., *See* Larese, J.Z., 15:913
Zheng, D.C., Relations between polarized-proton-nucleus and unpolarized-transverse-electron-nucleus scattering and applications, 15:1817 (J;US)
See Auerbach, N., 15:1813
Zhong, X., Theoretical construction of the magnetic Hamiltonian and zero-temperature anisotropic energy in $Nd_2Fe_{14}B$, 15:810 (J;US)
Zhou, Peizheng, *See* Graff, R.A., 15:4
Zhou, X., Monte Carlo study of photogenerated carrier transport in GaAs surface space-charge fields, 15:911 (J;US)
Zhou, Y., *See* Stell, G., 15:955
Zigler, A., *See* Bar-Shalom, A., 15:1915
Zimmerman, A.H., *See* Donley, S., 15:578
Zimmerman, M.G., 300 Area process trench sediment analysis report, 15:1304 (R;US)
Zinsmeyer, C.D., *See* Coose, J.P., 15:101
Zipperian, T.E., *See* Kurtz, S.R., 15:255
See Lott, J.A., 15:1077
Zisman, M.S., *See* Kramer, S.L., 15:1141
Zschornack, G., *See* Keiseler, D., 15:1194
See Wagner, W., 15:1193
Zucconi, L., Using object-oriented development to support prototyping, 15:1998 (R;US)
Zuclich, J.A., Ultraviolet-induced photochemical damage in the ocular tissues. Final report, 15:1418 (R;US)
Zumwalde, R.D., Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
Zurek, W.H., Algorithmic randomness, physical entropy, measurements, and the second law, 15:1880 (R;US)
Zwan, A.D., Arcjet validation of surface catalycity using a viscous shock-layer approach, 15:755 (RA;FR)
Zwiebach, B., *See* Saadi, M., 15:1768

Subject Index

This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, *EDB Subject Thesaurus* (DOE/OSTI-7000). In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

See references guide users from synonymous terms to the descriptors selected for the concept. *See also* references indicate subject concepts that are more specific than a particular descriptor. To gain complete subject coverage, all such terms should be reviewed.

A

A-BOMB SURVIVORS
The carcinogenic risks of low-LET and high-LET ionizing radiations, 15:1436 (R;US)

ABANDONED SITES
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
Results of the radiological survey at 5 Hancock Street, Lodi, New Jersey (LJ029), 15:1309 (R;US)
Results of the radiological survey at 7 Hancock Street, Lodi, New Jersey (LJ027), 15:1308 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)
St. Charles county well field monitoring project: Quarterly report, July, August and September 1989, 15:144 (R;US)

ABSORBED DOSES
See RADIATION DOSES

ACCELERATORS
See also COLLECTIVE ACCELERATORS
Computer control for a particle beam accelerator, 15:1137 (J;US)
Expert systems tactics in testing Fastbus Segment Interconnect modules: Lessons so far in the SIDES project, 15:1132 (J;US)
Exploratory studies, 1988, 15:1096 (R;US)
KAON physics, 15:1097 (R;CA)
The accelerator automation application toolkit workshop presentations, 15:1095 (R;US)
The development of a standard format for accelerator data analysis, 15:1127 (R;US)
[Advanced acceleration]: Foreign trip report, August 16–26, 1989, 15:1120 (R;US)
[High energy accelerators]: Foreign trip report, August 19, 1989–August 31, 1989, 15:1092 (R;US)
[Progresses and status of the AGS booster project]: Foreign trip report, August 9, 1989–August 27, 1989, 15:1093 (R;US)

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACCUMULATION (RADIOECOLOGICAL)
See RADIOECOLOGICAL CONCENTRATION

ACES
See QUARKS

ACETALS
Nucleoside adducts are formed by cooperative reaction of acetaldehyde and alcohols: Possible mechanism for the role of ethanol in carcinogenesis, 15:1464 (J;US)

ACETATES
Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)

ACETIC ACID
Biological evaluation of ^{99m}TC cis-Pt iminoacetic acid complexes as tumour imaging agents, 15:1396 (RA;AR)

ACID CARBONATES
Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)

ACID RAIN
Assessment of the importance of acidic fogwater and cloudwater in affecting terrestrial vegetation: Some important case studies, 15:1256 (R;US)
H.R. 5032: A bill Acid Rain/Energy Security Initiative Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988, 15:1295 (B;US)
H.R. 5211: Acid Rain Abatement Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 11, 1988, 15:42 (B;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)

ACOUSTIC DETECTION
Optical acoustic sensor using optical fiber, 15:1213 (R;JP;In Japanese)

ACOUSTIC MONITORING
Optical acoustic sensor using optical fiber, 15:1213 (R;JP;In Japanese)

ACQUISITION (DATA)
See DATA ACQUISITION

ACTINIDES
See also CURIUM
NEPTUNIUM
PLUTONIUM
THORIUM
URANIUM
[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)

ACTIVATED CARBON
Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:1338 (R;US)

ACTIVATION ANALYSIS
NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988, 15:932 (R;US)

ADENOCARCINOMAS
See CARCINOMAS

ADHESIVES
Use of peat in wood adhesives, 15:16 (R;FI;In Finnish)

ADSORPTION
Cooperative adsorption-desorption models with random steady states, 15:953 (J;US)

AEROSOLS
See also SMOKES
Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample, 15:519 (J;US)
Upper atmospheric research in Brazil, 15:1621 (RA;BR)

AHUACHAPAN GEOTHERMAL FIELD
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 3: Appendices F through I, 15:297 (R;US)

AIR
Hydraulic design on shaft-type energy dissipator of head-tank spillway, 15:237 (R;JP;In Japanese)

AIR CONDITIONERS
A cost-effective and fuel-conserving nonelectric air conditioner that combines engine-driven compression and absorption cycles, 15:728 (J;US)

AIR FILTERS
Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:1338 (R;US)

AIR POLLUTION
See also INDOOR AIR POLLUTION
Atmospheric modeling of air pollution. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 15:1276 (R;US)
Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986, 15:1263 (R;GB)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)
Trends of seasonal haziness and sulfur emissions over the eastern US, 15:1275 (R;US)

AIR POLLUTION ABATEMENT
Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)

AIR POLLUTION CONTROL
Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)

AIR QUALITY
Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986, 15:1268 (R;US)

AIR WALL IONIZATION CHAMBERS
See BRAGG GRAY CHAMBERS

AIR-FUEL RATIO
See FUEL-AIR RATIO

AIRBORNE PARTICLES
See PARTICULATES

AIRBORNE PARTICULATES
See PARTICULATES

AIRCRAFT FUELS
See AVIATION FUELS

AIRGLOW
Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)
Rocket measurements of the OI 557.7 NM and O_2 (0,0) 761,9 NM equatorial emissions, 15:1655 (RA;BR)

AIRPORTS
Alternate vehicle fuels unit, 15:599 (RA;US)

ALASKA
H.R. 4343: Arctic National Wildlife Refuge Energy Plan Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, March 31, 1988, 15:70 (B;US)
S. 684: Arctic Coastal Plain Competitive Oil and Gas Leasing Act. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 29, 1989, 15:69 (B;US)

ALASKA OIL PIPELINE
Air pollution: Status of dispute over Alaska oil pipeline air quality controls, 15:77 (R;US)

ALGAE
Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)
Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)
X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)

ALGORITHMS
Numerical methods: Analytical benchmarking in transport theory, 15:432 (J;US)

ALKALI METALS
See also CESIUM
LITHIUM
[Brief highlights of the Eleventh international vacuum congress]: Foreign trip report, September 23–30, 1989, 15:937 (R;US)

ALLOY 800H
See INCOLOY 800H

ALLOY SU31
See NIOBIUM BASE ALLOYS

ALLOY-50KH4N6G12F2V
See CHROMIUM ALLOYS

ALLOY-60T
See TITANIUM BASE ALLOYS

ALLOY-79NM
See NICKEL BASE ALLOYS

ALLOY-B-66
See NIOBIUM BASE ALLOYS

ALLOY-B-88
See NIOBIUM BASE ALLOYS

ALLOY-C-129Y
See NIOBIUM BASE ALLOYS

ALLOY-CB-1
See NIOBIUM BASE ALLOYS

ALLOY-CB-752
See NIOBIUM BASE ALLOYS

ALLOY-D-43
See NIOBIUM BASE ALLOYS

ALLOY-DH-245
See NIOBIUM BASE ALLOYS

ALLOY-FS-85
See NIOBIUM BASE ALLOYS

ALLOY-GE
See COPPER ALLOYS

ALLOY-GMR-235
See NICKEL BASE ALLOYS

ALLOY-HD-8077
See NICKEL BASE ALLOYS

ALLOY-HS-6
See STELLITE 6

ALLOY-KH20N80T
See NICKEL BASE ALLOYS

ALLOY-KHN77TYU
See NICKEL BASE ALLOYS

ALLOY-L-605
See COBALT BASE ALLOYS

ALLOY-M-252
See NICKEL BASE ALLOYS

ALLOY-MA-754
See NICKEL BASE ALLOYS

ALLOY-MA-956
See IRON BASE ALLOYS

ALLOY-MM-0011
See NICKEL BASE ALLOYS
ALLOY-VTZ-1
See TITANIUM BASE ALLOYS
ALLOY-VUS-6
See NIOBIUM BASE ALLOYS
ALLOY-WAZ-16
See NICKEL BASE ALLOYS
ALLUVIAL DEPOSITS
Preliminary description of quaternary and late pliocene surficial deposits at Yucca Mountain and vicinity, Nye County, Nevada, 15:172 (R;US)
ALPHA-BEARING WASTES
In-drum vitrification of transuranium waste sludge using microwave energy, 15:169 (R;US)
ALTERNATING CURRENT
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
ALTITUDE
Maximal aerobic capacity at several ambient concentrations of carbon monoxide at several altitudes. Research report, April 1984-January 1988, 15:1274 (R;US)
ALUMINIA
See ALUMINIUM OXIDES
ALUMINIUM
Shock compression studies of condensed matter, 15:947 (R;US)
ALUMINIUM 27 TARGET
Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy, 15:1778 (RA;DD)
Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
ALUMINIUM ALLOYS
A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)
Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)
Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
Deformation twinning in ordered intermetallic compounds, 15:765 (R;US)
Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989, 15:752 (R;US)
Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report, 15:881 (R;US)
ALUMINIUM ARSENIDE SOLAR CELLS
28% efficient GaAs concentrator solar cells, 15:261 (BA;US)
Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells, 15:265 (BA;US)
ALUMINIUM ARSENIDES
III-V compound process development using photoluminescence lifetime, 15:905 (BA;US)
Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs, 15:1040 (J;US)
Investigation of charge storage in InAs/AlAsSb quantum well capacitors, 15:1077 (J;US)
ALUMINIUM OXIDES
Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)
Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989, 15:752 (R;US)
The characteristics and effective utilization of a separate burnable absorber, 15:360 (J;US)
[Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988, 15:832 (R;US)
ALUMINUM
See ALUMINIUM
AMERICIUM ALLOYS
See also AMERICIUM BASE ALLOYS
[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)
AMERICIUM BASE ALLOYS
Magnetic behavior of curium and americium-curium alloys, 15:768 (R;US)
AMINES
See also POLYCYCLIC AROMATIC AMINES
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
AMINO ALCOHOLS
See AMINES
AMINO SUGARS
See AMINES
AMINOGLYCIDES
See AMINES
AMMONIA
Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)
AMYLUM
See STARCH
ANALOG RESONANCES
See RESONANCE
ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS
ANALYSIS (GAS)
See GAS ANALYSIS
ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY
ANGULAR DISTRIBUTION
Quantum-mechanical approaches to continuum angular distributions, 15:1881 (R;US)
ANHYDRIDES
Information profiles on potential occupational hazards: Organic anhydrides. Draft report (Second), 15:1459 (R;US)
ANIMAL CELLS
Amplification of oncogenes in early-stage, radiation-induced rat skin tumours, 15:1370 (R;US)
ANL
Synchrotron radiation sources to provide new probes of matter, 15:223 (J;US)
ANNIHILATION
Rate for annihilation of galactic dark matter into two photons, 15:1592 (R;US)
ANTARCTIC OCEAN
See SEAS
ANTARCTIC REGIONS
See also ANTARCTICA
Cretaceous-Tertiary boundary in the Antarctic: Climatic cooling precedes biotic crisis, 15:1528 (RA;US)
Evidence of volcanic ash at a K-T boundary section: Ocean drilling program hole 690 C, Maud Rise, Weddell Sea off East Antarctica, 15:1537 (RA;US)
Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions, 15:1475 (RA;US)
Volcanic ash layers in blue ice fields (Beardmore Glacier Area, Antarctica): Iridium enrichments, 15:1493 (RA;US)
ANTARCTICA
Antarctic surface temperature and pressure data, 15:1239 (R;US)
ANTIFERROMAGNETIC MATERIALS
Bosonic mean-field theory of quantum Heisenberg spin systems: Bose condensation and magnetic order, 15:1866 (J;US)
Paired-magnon analysis of quantum antiferromagnets, 15:1864 (J;US)
ANTIMONIDES
See also INDIUM ANTIMONIDES
Investigation of charge storage in InAs/AlAsSb quantum well capacitors, 15:1077 (J;US)
ANTIMONY IONS
$3p^6 3d^6 - 3p^5 3d^9$ Transitions in ironlike Sb, 15:1042 (J;US)

ANTIPROTON SOURCES
Improving the performance of power-limited transverse stochastic cooling systems, 15:1128 (R;US)
ANTS
Standard energy metabolism of a desert harvester ant, Pogonomyrmex rugosus: Effects of temperature, body mass, group size, and humidity, 15:1410 (J;US)
APPARATUS
See EQUIPMENT
APPENDIX (VERMIFORM)
See LYMPHATIC SYSTEM
APPLIANCES
See also GAS APPLIANCES
OVENS
STOVES
WOOD BURNING APPLIANCES
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 4, Appliances and equipment, 15:679 (R;US)
APPLICATORS (RADIOTHERAPY)
See RADIATION SOURCES
AQUATIC ECOSYSTEMS
See also WETLANDS
Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)
AQUATIC ORGANISMS
See also CRUSTACEANS
PLANKTON
SEAWEEDS
Environmental Sciences Division Toxicology Laboratory standard operating procedures, 15:1443 (R;US)
Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)
AQUEOUS HUMOR
See EYES
AQUEOUS SOLUTIONS
Activity coefficients in aqueous salt solutions: 2, Hydration theory equations, 15:1544 (R;US)
Selective pervaporation of organics from water, 15:938 (R;DE)
AQUIFERS
Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report, 15:1331 (R;US)
Contaminant transport in the Snake River Plain Aquifer: Phase 1, Part 1: Simple analytical model of individual plumes, 15:1298 (R;US)
Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation, 15:1332 (R;US)
ARCHAEOLOGICAL SITES
Savannah River Archaeological Research Program annual report, Fiscal years 1988–1989, 15:1362 (R;US)
ARCHAEOLOGY
Savannah River Archaeological Research Program annual report, Fiscal years 1988–1989, 15:1362 (R;US)
ARDENNES B-1 REACTOR
The CAD systems for Chooz-B nuclear power plant construction, 15:369 (J;US)
ARGON
Layer-by-layer growth of solid argon films on graphite as studied by neutron diffraction, 15:913 (J;US)
Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles, 15:1711 (J;US)
ARGON 41
Discharge of ^{41}Ar from a neutron activation analysis facility, 15:545 (J;US)
ARGON METHOD
See ISOTOPE DATING
ARGONNE NATIONAL LABORATORY
See ANL
ARGONNE SUPERCONDUCTING LINAC
See ATLAS SUPERCONDUCTING LINAC
ARIZONA
Mt. Trumbull and Mt. Logan wilderness management plan. Draft report, 15:623 (R;US)
Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:218 (B;US)
ARMS CONTROL
Force structure implications of START. Study project, 15:749 (R;US)
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
Soviet strategic nuclear doctrine under Gorbachev. Study project, 15:1225 (R;US)
ARMY PERSONNEL
See MILITARY PERSONNEL
ARRAY PROCESSORS
Utilizing multidimensional loop parallelism on large-scale parallel processor systems, 15:2008 (J;US)
ARSENIC
Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)
ARSENIC 83
Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)
ARTIFICIAL INTELLIGENCE
ATHENA AIDE, 15:460 (BA;US)
An OPS5-english english-OPS5 parser and language generator, 15:2001 (BA;US)
Application of neural networks for fault diagnosis in plant production, 15:1983 (R;US)
ASBESTOS
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
ASHES
See also FLY ASH
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
ASPHALTS
Energy use comparison between conventional reconstruction and hot-drum mix recycling for major trunk roads. A demonstration by Kent County Council. [Maidstone], 15:710 (R;GB)
ASTEROIDS
Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)
ATF TORSATRON
Studies of plasma performance and transport in the advanced toroidal facility (ATF), 15:1889 (R;US)
ATLANTIC OCEAN
Mass mortality and extraterrestrial impacts, 15:1492 (RA;US)
ATLAS SUPERCONDUCTING LINAC
Operational experience of the ATLAS accelerator, 15:1090 (R;US)
ATMOSPHERES
See also PLANETARY ATMOSPHERES
SOLAR ATMOSPHERE
Equation of state data of shock compressed liquid CO_2 and synthetic Uranus, 15:1604 (R;US)
ATMOSPHERIC CHEMISTRY
Ozone layer and the NASA airbone Antartic experiment of 1987, 15:1624 (RA;BR)
Study on atmospheric spectroscopy, 15:1675 (RA;BR)
ATMOSPHERIC CIRCULATION
Acute effects of a large bolide impact simulated by a global atmospheric circulation model, 15:1530 (RA;US)
Model evaluation studies, 15:1286 (R;US)
ATOMIC BEAMS
Isotopically selective optical deflection of a krypton atomic beam, 15:1706 (J;US)
ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC ENERGY
See NUCLEAR ENERGY
ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS
ATOMIC FLUORESCENCE SPECTROSCOPY
See FLUORESCENCE SPECTROSCOPY
ATOMIC SHELLS
See ELECTRONIC STRUCTURE
ATOMIC SHELLS (L)
See L SHELL
ATOMIC WEAPONS
See NUCLEAR WEAPONS
ATOMS
Angular and polarization correlations in photoionization and radiative recombination, 15:1713 (J;US)
Dynamics of resonances rapidly shifting under short laser pulses, 15:1704 (J;US)
ATWS
Reactivity transients during a blowdown in a MSIV closure ATWS, 15:514 (J;US)
AURORAE
See also POLAR-CAP AURORAE
Auroral plasma waves, 15:1688 (R;US)
Ionospheric scintillation studies. Final report, October 1984-September 1987, 15:1616 (R;US)
AURORAL ELECTROJETS
See ELECTROJETS
AURORAL ZONES
Study of low-energy electrons over the polar region by using the USAF (United States Air Force) operational DMSP satellite. Final technical report, 15:1619 (R;US)
AUSTENITIC STEELS
4.2 K fracture toughness of 304 stainless steel in a magnetic field, 15:780 (R;US)
The metallurgical determinants of toughness as cryogenic temperature, 15:779 (R;US)
AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
AUTOMOBILES
S. 2720: A bill requiring the use by the Federal Government of certain vehicles capable of operating on alcohol or natural gas fuels or on electricity in areas not in compliance with the Clean Air Act, and for other purposes. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, August 10, 1988, 15:748 (B;US)
AUTOMOTIVE FUELS
Alternative Motor Fuels Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 16, 1988, 15:747 (B;US)
Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:79 (R;US)
Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)
AVIATION FUELS
Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:79 (R;US)
AVR REACTOR
Loss-of-coolant accident experiment at the AVR gas-cooled reactor, 15:485 (R;US)
AZIDES
Information profiles on potential occupational hazards: Inorganic azides. Draft report (Second), 15:1452 (R;US)
AZO COMPOUNDS
See also AZO DYES
Information profiles on potential occupational hazards: Aminoazobenzenes. Draft report (Second), 15:1451 (R;US)
AZO DYES
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)

B

B MESONS
Getting maximum information from incomplete data on B → charmonium-K_S decays, 15:1721 (R;US)
Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD), 15:1163 (R;US)
BABCOCK AND WILCOX STANDARD REACTOR
See BW STANDARD REACTOR
BACKGROUND RADIATION
Great attractor really a great wall, 15:1570 (R;US)
BALL BEARINGS
Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989, 15:816 (R;US)
BALLISTIC MISSILE DEFENSE
Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll, 15:1363 (R;US)
High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim), 15:1022 (R;US)
Optimal sensor configuration and survivable processing with correlated noise. Final report, 15:1227 (R;US)
SDI (Strategic Defense Initiative): Shield or sword. Study Project, 15:2012 (R;US)
BANKS
See COMMERCIAL BUILDINGS
BARGES
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
BARIUM
Electron-impact cross sections and coherence parameters for the $6s^2\ ^1S$–6s6p ^1P transition in neutral barium, 15:1709 (J;US)
BARIUM COMPOUNDS
See also BARIUM HYDROXIDES
BARIUM OXIDES
Metal oxide films from carboxylate precursors, 15:817 (R;US)
Superconducting film fabrication by the sol-gel process, 15:825 (R;US)
BARIUM HYDROXIDES
Material degradation in a barium hydroxide latent heat storage pilot unit, 15:547 (R;FR)
BARIUM IONS
Angular and polarization correlations in photoionization and radiative recombination, 15:1713 (J;US)
BARIUM OXIDES
Charged-Particle Transport
Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy, 15:1870 (R;US)
Critical Current
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Critical Field
Angular dependence of the upper critical field of $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:864 (J;US)
Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds, 15:853 (J;US)
Diamagnetism
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Electric Conductivity
Temperature, frequency, and rf field dependence of the surface resistance of polycrystalline $YBa_2Cu_3O_{7-x}$, 15:859 (J;US)
Electrical Properties
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)

Electronic Structure
Electronic structure of monoclinic $BaBiO_3$, 15:1873 (R;US)
Photoemission and inverse-photoemission studies of $Ba_{1-x}K_xBiO_{3-y}$, 15:854 (J;US)
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)
Magnetic Properties
Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report, 15:879 (R;US)
Rotational magnetic processes in $YBa_2Cu_3O_7$, 15:875 (R;US)
Mechanical Properties
Application of neutron diffraction to the characterization of residual thermal strains in $YBa_2Cu_3O_{7-\delta}$/Ag, 15:849 (J;US)
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Phase Diagrams
Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system, 15:821 (R;US)
Physical Properties
Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$, 15:851 (J;US)
Physical Radiation Effects
Environmental effects on luminescence yield of superconducting $YBa_2Cu_3O_x$, 15:842 (J;US)
Spin Waves
Neutron scattering study of magnetic excitations in $YBa_2Cu_3O_{6+x}$, 15:852 (J;US)
Superconductivity
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Synthesis
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Twinning
Formation of coherent twins in $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:843 (J;US)
Very High Pressure
Pressure dependence of the Cu magnetic order in $RBa_2Cu_3O_{6+x}$, 15:860 (J;US)

BARYON NUMBER 2 RESONANCES
See DIBARYONS

BARYON RESONANCES
See BARYONS

BARYON-BARYON INTERACTIONS
See also NUCLEON-ANTINUCLEON INTERACTIONS
Baryon-baryon interaction and dibaryonic systems. Review and perspectives, 15:1725 (R;DE)

BARYONS
See also DIBARYONS
NUCLEONS
BRYNTRN: A baryon transport model, 15:1740 (R;US)
Effects of diquarks and mesons on baryon magnetic moments, 15:1755 (J;US)

BASALT
Deccan volcanism and K-T boundary signatures, 15:1506 (RA;US)
Flood basalt eruptions, comet showers, and mass extinction events, 15:1514 (RA;US)
Flood basalts and mass extinctions, 15:1505 (RA;US)
Some volcanologic aspects of Columbia River basalt volcanism relevant to the extinction controversy, 15:1533 (RA;US)

BASEMENT ROCK
Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)

BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES

BATTERY CHARGERS
Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989, 15:548 (R;US)

BEAM BENDING MAGNETS
Precision measurements of the SLC spectrometer magnets, 15:1131 (J;NL)

BEAM EXTRACTION
Precision measurements of the SLC spectrometer magnets, 15:1131 (J;NL)

BEAM INJECTION
See also ELECTRON BEAM INJECTION
The development of an expert system to tune a beam line, 15:1126 (R;US)

BEAM INJECTION HEATING
High energy density in matter produced by heavy ion beams. Annual report, 15:1894 (R;DE)
Studies on the production of high energy densities in matter by intense heavy-ion beams, 15:1895 (R;DE;In German)

BEAM OPTICS
Downstream ray tracing in beam-optics codes. Final report, September 1984-September 1987, 15:1100 (R;US)

BEAM TRANSPORT
Charged Particle Beam Research Program quarterly report, January–March 1989, 15:1102 (R;US)

BEARINGS
See also BALL BEARINGS
Cryogenic turbopump bearing materials, 15:985 (RA;US)
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)

BEAUFORT SEA
Artic oil-spill response guide for the alaskan beaufort sea. Final report, 15:68 (R;US)
Environmental measurements in the Beaufort Sea, Spring 1988. Technical report, 15:1322 (R;US)

BENZENE
Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)

BERYLLIUM
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

BERYLLIUM 9 TARGET
Mass and transverse momentum dependence of the dielectron yield in *p*-Be collisions at 4.9 GeV, 15:1787 (J;US)

BERYLLIUM BASE ALLOYS
High temperature Be panel development, 15:786 (R;US)

BERYLLIUM FLUORIDES
Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)

BERYLLIUM MODERATORS
See BERYLLIUM

BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS

BETA BEAMS (POSITRONS)
See POSITRON BEAMS

BETA PARTICLES
A comparison of TLD and Monte Carlo calculation for beta dosimetry, 15:1846 (J;US)

BICARBONATES
See ACID CARBONATES

BINARY ALLOY SYSTEMS
Molecular-dynamics simulation of thin-film growth, 15:899 (BA;US)

BINARY MIXTURES
Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus, 15:1061 (J;US)

BINARY STARS
The origin of ultra-compact binaries, 15:1583 (R;US)

BIOASSAY
Enzyme-based fiber optic sensors, 15:1376 (BA;US)

BIOCHEMICAL REACTION KINETICS
Base sequence effects on interactions of aromatic mutagens with DNA [deoxyribonucleic acid]: Progress report, December 1, 1988–October 15, 1989, 15:1371 (R;US)

Biological evaluation of ^{99m}TC cis-Pt iminoacetic acid complexes as tumour imaging agents, 15:1396 (RA;AR)

BIOCONVERSION
Low-temperature conversion of high-moisture biomass: Continuous reactor system results, 15:254 (R;US)

BIOGAS
See METHANE

BIOGAS PROCESS
Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead], 15:225 (R;GB)

BIOLOGICAL DOSEMETERS
Investigations on human blood cells for the diagnosis of radiation damage. Final report, 15:1420 (R;DE;In German)

BIOLOGICAL EXTINCTION

Age Estimation
Biostratigraphic case studies of six major extinctions, 15:1526 (RA;US)

Biological Effects
Executive overview of World Wildlife's conference on consequences of the greenhouse effect for biological diversity: Final project report, 15:1253 (R;US)

Frequency Analysis
Periodicity of extinction: A 1988 update, 15:1522 (RA;US)

Meetings
Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality, 15:1473 (R;US)
Report on an international workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure, 15:1517 (RA;US)

Meteorites
Impact as a general cause of extinction: A feasibility test, 15:1516 (RA;US)

Organic Sulfur Compounds
Climatic changes resulting from mass extinctions at the K-T boundary (and other bio-events), 15:1515 (RA;US)

Paleoclimatology
Climatic changes resulting from mass extinctions at the K-T boundary (and other bio-events), 15:1515 (RA;US)

Probability
Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)

Reviews
Biostratigraphic case studies of six major extinctions, 15:1526 (RA;US)
Cretaceous-Tertiary findings, paradigms and problems, 15:1508 (RA;US)
Permo-Triassic vertebrate extinctions: A program, 15:1510 (RA;US)

Simulation
Impact as a general cause of extinction: A feasibility test, 15:1516 (RA;US)

Stratigraphy
Biostratigraphic case studies of six major extinctions, 15:1526 (RA;US)

Temperature Effects
Climatic changes resulting from mass extinctions at the K-T boundary (and other bio-events), 15:1515 (RA;US)

Toxic Materials
Heavy metal toxicity as a kill mechanism in impact caused mass extinctions, 15:1535 (RA;US)

Variations
Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions, 15:1475 (RA;US)

Volcanoes
Evidence of volcanic ash at a K-T boundary section: Ocean drilling program hole 690 C, Maud Rise, Weddell Sea off East Antarctica, 15:1537 (RA;US)
Step-wise extinctions at the Cretaceous-Tertiary boundary and their climatic implications, 15:1501 (RA;US)
Volcanoes and global catastrophes, 15:1525 (RA;US)

BIOLOGICAL RADIATION EFFECTS
Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)

BIOLOGICAL SHIELDS
Simplified determination of radiation environment outside BSW penetrations, 15:543 (J;US)

BIOLOGICAL STRESS
Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)

BIOLOGICAL TESTING
See BIOASSAY

BIOLOGICAL WARFARE
Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989, 15:1224 (R;US)

BIOMASS
Low-temperature conversion of high-moisture biomass: Continuous reactor system results, 15:254 (R;US)
Process for producing ethanol from plant biomass using the fungus paecilomyces sp, 15:229 (P;US)

BIOMASS PLANTATIONS
Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report, 15:647 (R;US)

BIOMEDICAL RADIOGRAPHY
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)
Focal heavy charged particle irradiation of the mammalian cortex: Temporal pattern of changes followed by magnetic resonance imaging and positron emission tomography, 15:1435 (R;US)

BISMUTH COMPOUNDS
See also BISMUTH OXIDES
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

BISMUTH OXIDES
Characterization and superconducting properties of phases in the Bi-Sr-Cu-O system, 15:844 (J;US)
Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system, 15:862 (J;US)
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Photoemission and inverse-photoemission studies of $Ba_{1-x}K_xBiO_{3-y}$, 15:854 (J;US)
Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system, 15:821 (R;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)

BITUMINOUS COAL
Acoustical and dielectric loss in natural macromolecular solids, 15:22 (BA;NL)

BLACK HOLES
Gravitational radiation from extreme Kerr black hole, 15:1594 (R;US)
Ideal black hole fluid, 15:1571 (R;US)
Ideal black hole gas, 15:1593 (R;US)

BLACK LUNG DISEASE
See PNEUMOCONIOSES

BLADES (COMPRESSOR)
See COMPRESSOR BLADES

BLADES (TURBINES)
See TURBINE BLADES

BLANKETS (BREEDING)
See BREEDING BLANKETS
BLENDING
See MIXING
BLOOD
See also BLOOD CELLS
Sequential rat blood boron concentration measurements method using CR-39 SSNTDs, 15:1406 (J;US)
BLOOD CELLS
See also LEUKOCYTES
Investigations on human blood cells for the diagnosis of radiation damage. Final report, 15:1420 (R;DE;In German)
BNL
Biotechnology at Brookhaven National Laboratory, 15:1366 (R;US)
BOILER FUEL
See BOILER FUELS
BOILER FUELS
Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead], 15:225 (R;GB)
BOILERS
Application of combustion air pre-heating to 50t/h water tube boilers. A demonstration at British Sugar plc. [York], 15:711 (R;GB)
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)
Gas reburning-sorbent injection for controlling SO_{chi} and NO_{chi} utility boilers, 15:312 (B;US)
Kraft recovery boiler physical and chemical processes, 15:699 (B;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
Western New York State coal-water fuel market and boiler-conversion study. Final report, 15:32 (R;US)
BOILING WATER COOLED AND MODERATED REACTOR
See BWR TYPE REACTORS
BOLOMETERS
Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)
BONES
See SKELETON
BONN SYNCHROTRON
Development of the software of the data taking system SOS for the SAPHIR experiment, 15:1981 (R;DE;In German)
BOOSTERS (PARTICLE)
See PARTICLE BOOSTERS
BORON
A null-type instrument for on-line boron analysis, 15:364 (J;US)
BORON 10
Sequential rat blood boron concentration measurements method using CR-39 SSNTDs, 15:1406 (J;US)
BORON 10 TARGET
Photoproduction of pions off nucleons and nuclei, 15:1735 (R;SU)
BORON ALLOYS
Theoretical construction of the magnetic Hamiltonian and zero-temperature anisotropic energy in $Nd_2Fe_{14}B$, 15:810 (J;US)
BORON CARBIDES
Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)
Boron carbide structure by Raman spectroscopy, 15:866 (J;US)
The characteristics and effective utilization of a separate burnable absorber, 15:360 (J;US)
BOROSILICATE GLASS
Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)
Analytical electron microscopy of leached nuclear waste glasses, 15:139 (R;US)
Studies of the adsorption/desorption behavior of explosive-like molecules, 15:1222 (R;US)
Use of borosilicate glass in fissile operations at Savannah River (U), 15:897 (R;US)
BOROSILICATES
See BOROSILICATE GLASS

BOUNDARY LAYERS
Age Estimation
Cretaceous-Tertiary boundary marine extinction and global primary productivity collapse, 15:1539 (RA;US)
Carbon Isotopes
Cretaceous-Tertiary boundary marine extinction and global primary productivity collapse, 15:1539 (RA;US)
Drill Cores
Evidence of volcanic ash at a K-T boundary section: Ocean drilling program hole 690 C, Maud Rise, Weddell Sea off East Antarctica, 15:1537 (RA;US)
Seawater strontium isotopes at the Cretaceous-Tertiary boundary, 15:1498 (RA;US)
Fossils
Macrofossil extinction patterns at Bay of Biscay Cretaceous-Tertiary boundary sections, 15:1534 (RA;US)
Geochemistry
Geochemical comparison of K-T boundaries from the Northern and Southern Hemispheres, 15:1531 (RA;US)
Impact and extinction signatures in complete Cretaceous-Tertiary (K-T) boundary sections, 15:1527 (RA;US)
K-T impact(s): Continental, oceanic or both, 15:1523 (RA;US)
Marine and continental K-T boundary clays compared, 15:1520 (RA;US)
Mass mortality and extraterrestrial impacts, 15:1492 (RA;US)
Mineralogical and geochemical anomalous data of the K-T boundary samples, 15:1504 (RA;US)
Mineralogy and phase-chemistry of the Cretaceous/Tertiary section in the Lattengebirge, Bavarian Alps, 15:1484 (RA;US)
Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause, 15:1489 (RA;US)
Trace element and isotope geochemistry of Cretaceous-Tertiary boundary sediments: identification of extra-terrestrial and volcanic components, 15:1500 (RA;US)
Western North American Cretaceous-Tertiary (K-T) boundary interval and its content of shock-metamorphosed minerals: Implications concerning the K-T boundary impact-extinction theory, 15:1491 (RA;US)
Iridium
Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean, 15:1490 (RA;US)
Mass mortality and extraterrestrial impacts, 15:1492 (RA;US)
Western North American Cretaceous-Tertiary (K-T) boundary interval and its content of shock-metamorphosed minerals: Implications concerning the K-T boundary impact-extinction theory, 15:1491 (RA;US)
Mineralogy
Impact and extinction signatures in complete Cretaceous-Tertiary (K-T) boundary sections, 15:1527 (RA;US)
K-T impact(s): Continental, oceanic or both, 15:1523 (RA;US)
Marine and continental K-T boundary clays compared, 15:1520 (RA;US)
Platinum Metals
Geochemical comparison of K-T boundaries from the Northern and Southern Hemispheres, 15:1531 (RA;US)
Quartz
Catastrophic volcanism as a cause of shocked features found at the K/T boundary and in cryptoexplosion structures, 15:1497 (RA;US)
Cathodoluminescence of shocked quartz at the Cretaceous-Tertiary boundary, 15:1511 (RA;US)
Stable Isotopes
Cretaceous-Tertiary boundary in the Antarctic: Climatic cooling precedes biotic crisis, 15:1528 (RA;US)
Trace element and isotope geochemistry of Cretaceous-Tertiary boundary sediments: identification of extra-terrestrial and volcanic components, 15:1500 (RA;US)
Stratigraphy
Bio-, Magneto- and event-stratigraphy across the K-T boundary, 15:1512 (RA;US)
Strontium Isotopes
Impact production of NO and reduced species, 15:1540 (RA;US)

Seawater strontium isotopes at the Cretaceous-Tertiary boundary, 15:1498 (RA;US)

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BRAGG GRAY CHAMBERS
Gas detectors for heavy ions, 15:1164 (R;FR;In French)

BRAIN
Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)
Effects of spatial attention on the visual-evoked neuromagnetic response, 15:1402 (R;US)
PBF/BNCT [Power Burst Facility/Boron Neutron Capture Therapy] Program for cancer treatment: Bulletin, 15:1428 (R;US)
PBF/BNCT [power burst facility/boron neutron capture therapy] program for cancer treatment: Volume 3, No. 6, 15:1429 (R;US)
PBF/BNCT program for cancer treatment: Volume 3, No. 7, Bulletin, 15:1430 (R;US)

BREAKERS (CIRCUIT)
See CIRCUIT BREAKERS

BREAKWATERS
See DAMS

BREEDING BLANKETS
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION

BRICKS
Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)

BROMINATED ALIPHATIC HYDROCARBONS
Review and evaluation of recent scientific literature relevant to an occupational standard for ethylene dibromide, 15:1449 (R;US)

BRONCHOGENIC CARCINOMA
See CARCINOMAS
RESPIRATORY SYSTEM DISEASES

BROOKHAVEN NATIONAL LABORATORY
See BNL

BROWN COAL
Analysis and comparison of two Victorian Brown Coal resinite samples, 15:18 (R;US)

BSF REACTOR
See BSR-1 REACTOR

BSR-1 REACTOR
Building Shielding Facility quarterly report, April, May, and June 1989, 15:499 (R;US)

BSR-2 REACTOR
Building Shielding Facility quarterly report, April, May, and June 1989, 15:499 (R;US)

BUBBLES
Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus, 15:1061 (J;US)

BUCKLING (STRUCTURAL)
See DEFORMATION

BUILDERS
The selection and use of VA/VE [Value Analysis/Value Engineering] professionals, 15:999 (R;US)

BUILDING (CONSTRUCTING)
See CONSTRUCTION

BUILDING CONTRACTORS
See BUILDERS

BUILDINGS
See also COMMERCIAL BUILDINGS
FEDERAL BUILDINGS
LABORATORY BUILDINGS
OFFICE BUILDINGS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Index volume, Subject and author index, 15:676 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 11, Behavior and lifestyle, 15:635 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 5, National and regional conservation programs, 15:634 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 6, Utility and private sector conservation programs, 15:680 (R;US)
Application of solar technologies in buildings, 15:280 (R;US)
DOE-2 BDL [Building Description Language] summary, Version 2.1D: Revision 5, 15:690 (R;US)
DOE-2 Sample Run Book, Version 2.1D: Revision 3, 15:689 (R;US)
DOE-2 Supplement, Version 2.1D: Revision 5, 15:691 (R;US)
Local Government Operations, 15:627 (RA;US)
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)

BULK SHIELDING REACTOR-1
See BSR-1 REACTOR

BULK SHIELDING REACTOR-2
See BSR-2 REACTOR

BURNERS
Development and testing of a staged-mixing burner with injection of additives for the simultaneous reduction of SO_2 and NO_x emissions in coal and oil firing systems, 15:1085 (R;DE;In German)

BURNUP
Forward versus backward Kolmogorov equations with feedback, 15:442 (J;US)

BURSA OF FABRICIUS
See LYMPHATIC SYSTEM

BW STANDARD REACTOR
The characteristics and effective utilization of a separate burnable absorber, 15:360 (J;US)

BWR TYPE REACTORS
See also CLINTON-1 REACTOR
CLINTON-2 REACTOR
ENRICO FERMI-2 REACTOR
GE STANDARD REACTOR
GRAND GULF-1 REACTOR
GRAND GULF-2 REACTOR
HOPE CREEK-1 REACTOR
HOPE CREEK-2 REACTOR
OYSTER CREEK-1 REACTOR
PEACH BOTTOM-2 REACTOR
PEACH BOTTOM-3 REACTOR
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)

Capitalized Cost
Economic potential for future water reactors, 15:350 (J;US)

Fuel Assemblies
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)

Fuel Management
Mutual incidences of reactor operation and strategies for core refueling, 15:349 (J;US)
Operating plant scorecard: A statistical analysis of plant outage performance, 15:348 (J;US)
The influence of fuel cycle duration on nuclear unit performance, 15:347 (J;US)

Fuel Rods
Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers, 15:343 (J;US)
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)

Heat Transfer
Thermophoretic transport of particles that act as volumetric heat sources in natural convection flow, 15:338 (R;US)

Power Systems
ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)

Pressure Vessels
Dosimetry-adjusted reactor physics parameters for pressure vessel neutron exposure assessment, 15:351 (J;US)

The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry, 15:352 (J;US)

Reactor Components
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)

Reactor Cooling Systems
Application of an industrial gas supply system to a hydrogen water chemistry installation, 15:353 (J;US)

Reactor Physics
LEOPARD on a personal computer, 15:341 (J;US)

Reactor Safety
LWR fuel rod bundle behavior under severe fuel damage conditions, 15:533 (J;US)
Reactivity transients during a blowdown in a MSIV closure ATWS, 15:514 (J;US)
Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document, 15:523 (J;US)
Utilization of simulation data for control system reliability analysis, 15:462 (J;US)

Service Life
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)

Spent Fuel Elements
Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions, 15:183 (J;US)

Spent Fuel Storage
Analysis of a hypothetical criticality excursion during misloading of a high-capacity spent-fuel cask, 15:1008 (J;US)
Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)

Spent Fuels
LWR spent-fuel radiochemical measurements and comparison with ORIGEN2 predictions, 15:184 (J;US)
Status of spent-fuel transportation system development, 15:131 (J;US)
Studies on the back end of the nuclear fuel cycle, 15:413 (J;US)
The contribution of spent-fuel shipping cask residual contamination to the transportation source term, 15:130 (J;US)

Steam Systems
Acoustic monitoring of BWR main steam safety relief valves, 15:546 (J;US)

Water Hammer
Avoiding steam-bubble-collapse-induced water hammers in piping systems, 15:336 (R;US)

BWR/6 TYPE REACTORS
See GE STANDARD REACTOR

C

C CODES
Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)

CABLES
See also ELECTRIC CABLES
2000 MCM electrical power jumper cable with controlled flexibility: Design and life cycle test, 15:1954 (R;US)

CABLES (ELECTRIC)
See ELECTRIC CABLES

CADMIUM
Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)
Electrodeposition of cadmium from aqueous fluoborate electrolytes, 15:801 (B;US)

CADMIUM TELLURIDES
Raman and RBS studies of ion implanted semiconductors, 15:869 (R;US)
Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989, 15:880 (R;US)

CALCIUM
On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)

CALCIUM 40
$0^+, T=0(p,p')0^-, T=1$ pion like excitations and nuclear response in the spin-isospin channel, 15:1825 (J;US)

CALCIUM 40 TARGET
$0^+, T=0(p,p')0^-, T=1$ pion like excitations and nuclear response in the spin-isospin channel, 15:1825 (J;US)
Quasielastic (e,e') sum rule saturation, 15:1820 (J;US)
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)

CALCIUM 42 TARGET
Relations between polarized-proton-nucleus and unpolarized-transverse-electron-nucleus scattering and applications, 15:1817 (J;US)

CALCIUM COMPOUNDS
See also CALCIUM OXIDES
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

CALCIUM OXIDES
Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system, 15:862 (J;US)
Fossil energy research program: Project status quarterly report, April 1–June 30, 1989, 15:30 (R;US)
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)

CALIFORNIA
Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:218 (B;US)

CALORIMETERS
A calorimeter for relativistic heavy-ion experiments, 15:1203 (J;NL)
Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector, 15:1170 (R;DE;In German)
International workshop on calorimeter simulation, 15:1166 (R;DE)
Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)

CALORIMETERS (PARTICLE)
See SHOWER COUNTERS

CAMAC SYSTEM
Automatic control of a laboratory system, 15:1103 (J;US)
CAMAC control of diverse data acquisition instrumentation, 15:470 (J;US)

CANADA
Achieving an energy-secure economy: Options for Illinois and the Midwest, 15:643 (RA;US)
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)
Free market economics: Graphs and figures, 15:644 (RA;US)
S. 2096: Canadian Free Trade Agreement Incentive Equalization Act. Introduced in the Senate of the United States. One Hundredth Congress, Second Session, February 25, 1988, 15:72 (B;US)

CANCER
See NEOPLASMS

CANDU TYPE REACTORS
See also NPD REACTOR
PICKERING-1 REACTOR
PICKERING-2 REACTOR

CANDU-3: Advances in engineering and construction, 15:389 (J;US)
Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample, 15:519 (J;US)
Event sequence of a severe accident in a single-unit CANDU reactor, 15:534 (J;US)

CAPACITORS
Investigation of charge storage in InAs/AlAsSb quantum well capacitors, 15:1077 (J;US)
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)

CAPITAL COSTS
See CAPITALIZED COST

CAPITALIZED COST
Economic goals for the ALWR and sensitivity to cost parameters, 15:381 (J;US)
Economic potential for future water reactors, 15:350 (J;US)

CARBON
See also ACTIVATED CARBON
GRAPHITE
Interactions between two identical polymer chains studied with first-principles calculations, 15:956 (J;US)

CARBON 12
Double Gamow–Teller strength in nuclei, 15:1813 (J;US)

CARBON 12 TARGET
Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)
Theoretical aspects of pion photoproduction off light nuclei, 15:1736 (R;SU)

CARBON 14
Contribution of subsoil and aquifer microorganisms to groundwater quality. Technical report, 1 July 1988-30 June 1989. (Final), 15:1334 (R;US)

CARBON DIOXIDE
A simplified representation for the thermal conductivity of fluids in the critical region, 15:949 (J;US)
Carbon dioxide and climate. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1277 (R;US)
Carbon dioxide and climate. January 1970-July 1989 (Citations from Pollution Abstracts). Report for January 1970-July 1989, 15:1278 (R;US)
H.R. 2266: Pipeline Safety Reauthorization Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, April 21, 1988, 15:98 (B;US)
Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
Statistical treatment of CO_2 data records. Technical memo, 15:1266 (R;US)
Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations, 15:1257 (R;US)

CARBON DIOXIDE INJECTION
Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)

CARBON DIOXIDE LASERS
A compact, high-powered far-infrared (FIR) laser: Technical progress report, January 22, 1988 to present, 15:1028 (R;US)
Design of catalytic monoliths for closed-cycle carbon dioxide lasers. Final report, 15:1032 (R;US)

CARBON MONOXIDE
Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988–December 15, 1988, 15:6 (R;US)
Maximal aerobic capacity at several ambient concentrations of carbon monoxide at several altitudes. Research report, April 1984-January 1988, 15:1274 (R;US)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)
[Brief highlights of the Eleventh international vacuum congress]: Foreign trip report, September 23–30, 1989, 15:937 (R;US)

CARBON MONOXIDE LASERS
$^{12}C^{16}O$ laser frequency tables for the 34.2 to 62.3 THz (1139 to 2079/cm) region, 15:1035 (R;US)

CARCINOGENESIS
Nucleoside adducts are formed by cooperative reaction of acetaldehyde and alcohols: Possible mechanism for the role of ethanol in carcinogenesis, 15:1464 (J;US)
The carcinogenic risks of low-LET and high-LET ionizing radiations, 15:1436 (R;US)

CARCINOGENS
Pharmacokinetics in risk assessment: drinking water and health. Volume 8, 15:1445 (R;US)
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
Workshop report on EPA (Environmental Protection Agency) guidelines for carcinogen risk assessment. Held in Virginia Beach, Virginia on January 11-13, 1989, 15:1462 (R;US)

CARCINOMAS
Influence of monofluormethylhistidine (MFMH) on the mammary adenocarcinoma M-2, 15:1398 (RA;AR)
Modulation of lymphopoiesis: Annual report, 15:1424 (R;US)

CARLSON METHOD
See DISCRETE ORDINATE METHOD

CASCADE (EXTRACTION)
See EXTRACTION COLUMNS

CASCADE SOLAR CELLS
A 21.8% $GaInP_2$/GaAs tandem solar cell, 15:270 (BA;US)

CAST IRON
Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties, 15:770 (R;GB)

CATALYSTS
See also ELECTROCATALYSTS
Low-temperature conversion of high-moisture biomass: Continuous reactor system results, 15:254 (R;US)
Oxidative coupling catalyst research for the conversion of natural gas to liquid fuels, 15:88 (B;US)
Recovery and reuse of cellulase catalyst in an exzymatic cellulose hydrolysis process, 15:233 (P;US)

CATALYTIC REFORMING
Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough], 15:706 (R;GB)

CATAPHORESIS
See ELECTROPHORESIS

CATHODES
Electrochemical behavior of niobium triselenide cathode in lithium secondary cells, 15:572 (BA;US)

CATION EXCHANGE CAPACITY
See ION EXCHANGE

CAVITATION
Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)

CAVITY IONIZATION CHAMBERS
See BRAGG GRAY CHAMBERS

CE STANDARD REACTOR
Combustion engineering nuclear plant performance trends, 15:379 (J;US)
Evaluation of erbia as a burnable absorber in a 24-month, low-leakage C-E core, 15:362 (J;US)

CEBAF ACCELERATOR
Test results on a CEBAF/Cornell prototype superconducting cavity fabricated by TRW, 15:1130 (BA;US)

CELL CULTURES
Synthesis and properties of 1-(4-iodo-5nitroimidazolyl)-2-hydroxy-3 methoxypropane. A novel radiosensitizer for use as an hypoxic cell marker, 15:963 (RA;AR)
CELL GROWTH (ANIMAL)
See ANIMAL CELLS
CELLS (ANIMAL)
See ANIMAL CELLS
CELLULASE
Recovery and reuse of cellulase catalyst in an exzymatic cellulose hydrolysis process, 15:233 (P;US)
CELLULASES
See CELLULASE
CELLULOSE
Recovery and reuse of cellulase catalyst in an exzymatic cellulose hydrolysis process, 15:233 (P;US)
CERAMIC MELTERS
The DWPF Melter proposed heat up sequence, 15:178 (R;US)
CERAMICS
Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989, 15:816 (R;US)
Principles and methods for the testing of high-performance ceramics. A survey, 15:1063 (R;DE;In German)
Superconductor precursor mixtures made by precipitation method, 15:1016 (P;US)
[7th international conference on ceramics]: Foreign trip report, December 12–18, 1988, 15:835 (R;US)
[Application of electron microscopy for the analysis of the mechanical behavior of advanced ceramics]: Foreign trip report, June 3, 1988–June 13, 1988, 15:831 (R;US)
[Ceramic powder characterization]: Foreign trip report, October 7–14, 1988, 15:834 (R;US)
[Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988, 15:832 (R;US)
[Surface engineering by high energy beams]: Foreign trip report, September 23–October 6, 1989, 15:1853 (R;US)
[Surface modification of metals by ion beams]: Foreign trip report, August 24, 1988–October 11, 1988, 15:833 (R;US)
CERIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
CERIUM ALLOYS
Magnetic behavior of $Ce(Cu_{1-x}Ag_x)_6$, 15:809 (J;US)
CERIUM SILICIDES
$CeRu_2Si_2$ and URu_2Si_2: Same or different?, 15:870 (R;US)
CESIUM
Development of a wet vapor homogeneous liquid metal MHD power system: Semi-annual report, October 1988–March 1989, 15:655 (R;US)
Shock compression studies of condensed matter, 15:947 (R;US)
CESIUM 133
Nucleon and nuclear anapole moments, 15:1815 (J;US)
CESIUM 137
Inspection of contaminated hot cell ductwork, 15:991 (R;US)
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)
Nursering assistance to the radiological accident patients in Goiania-an experience report, 15:1434 (R;BR;In Portuguese)
Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)
CHALKS
See LIMESTONE
CHARGE PLUNGER METHOD
Construction of a plunger for coincidence experiments, 15:1179 (RA;DD)
CHARGED PARTICLES
See also BETA PARTICLES
IONS
Charged Particle Beam Research Program quarterly report, January–March 1989, 15:1102 (R;US)
Medium energy charged particle data for evaluation, 15:1774 (R;US)
CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS
CHARGED PARTICLES
CHARGED-PARTICLE PRECIPITATION
See also ELECTRON PRECIPITATION
Effects of corotation electric field on the dynamic of energetic particles in an asymetric planetary magnetic field, 15:1567 (RA;BR)
CHARGED-PARTICLE TRANSPORT
See also PROTON TRANSPORT
Discrete ordinates methods for radiation transport, 15:473 (R;US)
Medium energy charged particle data for evaluation, 15:1774 (R;US)
CHARGING (REACTOR)
See REACTOR FUELING
CHARPAK CHAMBERS
See MULTIWIRE PROPORTIONAL CHAMBERS
CHARS
Coal combustion science: Quarterly progress report, April–June 1989, 15:33 (R;US)
CHEMICAL EFFLUENTS
Environmental Sciences Division Toxicology Laboratory standard operating procedures, 15:1443 (R;US)
CHEMICAL ENGINEERING
Highly concurrent dynamic simulation in chemical engineering, 15:1999 (B;US)
Physicochemical fundamental of chemical fundamentals of chemical technology. Issue 150. Proceedings of Institute, 15:916 (R;SU;In Russian)
CHEMICAL EXPLOSIONS
Detonation chemistry studies of energetic materials using laboratory scale samples, 15:1221 (R;US)
CHEMICAL EXPLOSIVES
Detonation chemistry studies of energetic materials using laboratory scale samples, 15:1221 (R;US)
Studies of the adsorption/desorption behavior of explosive-like molecules, 15:1222 (R;US)
CHEMICAL INDUSTRY
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Waste heat recovery from the absorption stage of a sulphuric acid plant. Demonstration project at Berk Spencer Acids Ltd., London, 15:702 (R;GB)
CHEMICAL LASERS
Laser-mixing processes. Final report, 1 July 1977-31 October 1978, 15:1025 (R;US)
CHEMICAL LOGGING
Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)
CHEMICAL PLANTS
Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough], 15:706 (R;GB)
CHEMICAL PROPERTIES
Physical and chemical interactions in irradiated water containing DNA, 15:1423 (R;US)
CHEMICAL REACTION KINETICS
See also COMBUSTION KINETICS
Block Lanczos approach combined with matrix continued fraction for the *S*-matrix Kohn variational principle in quantum scattering, 15:954 (J;US)
CHEMICAL REACTIONS
See also FISCHER-TROPSCH SYNTHESIS
OXIDATION
OZONIZATION
Cold nuclear fusion and muon-catalyzed fusion. January 1976-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1976-April 1989, 15:1718 (R;US)

CHEMICAL WARFARE
Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989, 15:1224 (R;US)

CHEMICAL WASTES
The effect of liner hydraulic conductivity on disposal cell performance, 15:188 (J;US)

CHEMISTRY
See also ATMOSPHERIC CHEMISTRY
NUCLEAR CHEMISTRY
PHOTOCHEMISTRY
PHYSICAL CHEMISTRY
Physicochemical fundamental of chemical fundamentals of chemical technology. Issue 150. Proceedings of Institute, 15:916 (R;SU;In Russian)

CHERNOBYLSK-4 REACTOR
Economic consequences of the Chernobyl accident in Norway in 1986 and 1987, 15:535 (J;US)
Implications of the Chernobyl accident for US reactors, 15:526 (J;US)
Reactivity calculations of the Chernobyl accident, 15:530 (J;US)
Simulation of atmospheric dispersion of radioactivity from the Chernobyl accident, 15:1437 (R;US)
The radiological impact of the Chernobyl accident, 15:524 (J;US)
Update and comparisons of dose estimates following the Chernobyl accident, 15:536 (J;US)
Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)

CHEST
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)

CHICAGO
Energy purchasing alternative: Chicago reviews its position, 15:641 (RA;US)

CHINESE TALLOW TREE
Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report, 15:647 (R;US)

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY

CHLORINATED ALIPHATIC HYDROCARBONS
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)

CHLORINATED AROMATIC HYDROCARBONS
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Information profiles on potential occupational hazards: Chlorophenols. Draft report (Second), 15:1457 (R;US)
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final, 15:732 (R;US)
Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis, 15:1330 (R;US)
Toxicology and carcinogenesis studies of two pentachlorophenol technical-grade mixtures (CAS No. 87-86-5) in B6C3F1 mice (feed studies). Technical report series, 15:1458 (R;US)
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)

CHLORINE IONS
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)

CHLOROPLASTS
Altered regulation of lipid biosynthesis in a mutant of Arabidopsis deficient in chloroplast glycerol-3-phosphate acyltransferase activity, 15:1380 (J;US)

CHONDRITES
Heavy metal toxicity as a kill mechanism in impact caused mass extinctions, 15:1535 (RA;US)

CHOOZ B-1 REACTOR
See ARDENNES B-1 REACTOR

CHROMATOGRAPHIC COLUMNS
See EXTRACTION COLUMNS

CHROMIUM
Chromium toxicity. January 1987-April 1989 (Citations from the Life Sciences Collection data base). Report for January 1987-April 1989, 15:1409 (R;US)
Magnetotransport studies of epitaxial Cr thin films, 15:764 (R;US)
The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)

CHROMIUM ALLOYS
A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)
Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation, 15:798 (R;US)
The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)

CHROMIUM COMPOUNDS
See also CHROMIUM SILICIDES
Information profiles on potential occupational hazards: Inorganic chromium compounds. Draft report (Second), 15:1460 (R;US)

CHROMIUM SILICIDES
Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report, 15:883 (R;US)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CHROMOSPHERE
Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)

CHRONIC EXPOSURE
Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)

CIRCUIT BREAKERS
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)

CIRCUITS (ELECTRONIC)
See ELECTRONIC CIRCUITS

CITIES
See URBAN AREAS

CIVIL ENGINEERING
The selection and use of VA/VE [Value Analysis/Value Engineering] professionals, 15:999 (R;US)

CLAMS
Development and application of a new material for control of asiatic clams, 15:410 (J;US)

CLEAN AIR ACT
H.R. 5032: A bill Acid Rain/Energy Security Initiative Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988, 15:1295 (B;US)
H.R. 5211: Acid Rain Abatement Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 11, 1988, 15:42 (B;US)

CLEAN WATER ACT
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)

Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)

CLIMATE MODELS
Parameterization of ice- and water clouds and their radiation-transport properties for large-scale atmospheric models, 15:1237 (R;DE;In German)

CLIMATES
A compendium of options for government policy to encourage private sector responses to potential climate changes: Volume 1, Methodological justification and generic policy instruments, 15:1328 (R;US)
A compendium of options for government policy to encourage private sector responses to potential climate change: Volume 2, Policy options by sector and considerations for assembling a policy package, 15:1329 (R;US)
Carbon dioxide and climate. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1277 (R;US)
Carbon dioxide and climate. January 1970-July 1989 (Citations from Pollution Abstracts). Report for January 1970-July 1989, 15:1278 (R;US)
Quantifying the link between change in radiative balance and atmospheric temperature, 15:1280 (R;US)

CLINTON-1 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)

CLINTON-2 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)

CLOSURES
Demonstrations of technology for remediation and closure of Oak Ridge National Laboratory waste disposal sites, 15:165 (R;US)
Savannah River Laboratory Seepage Basins: Waste site assessment report, 15:1305 (R;US)

CLUSTERS (GALAXY)
See GALAXY CLUSTERS

CO-GENERATION
See COGENERATION

CO2 FLOODING
See CARBON DIOXIDE INJECTION

COAL
See also BROWN COAL
SUBBITUMINOUS COAL

Air Pollution
Clean-coal technologies - a Midwest project update, 15:642 (RA;US)

Ashes
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)

Bioconversion
Approaches to cleaning and conversion of coal through bioprocessing, 15:8 (R;US)

Chemical Analysis
Identification of the heteroatom containing compounds in the benzene/methanol extracts of the Argonne Premium Coal Samples, 15:17 (R;US)

Cleaning
Proceedings: Reducing power plant emissions by controlling coal quality, 15:310 (R;US)

Combustion
A combustion/deposition entrained reactor for high temperature/pressure studies of coal and coal minerals, 15:35 (B;US)
Coal combustion modeling: Particulate and gas phase heat transfer effects, 15:34 (B;US)
Coal combustion science: Quarterly progress report, April–June 1989, 15:33 (R;US)
Gas reburning-sorbent injection for controlling SO_{chi} and NO_{chi} utility boilers, 15:312 (B;US)

Combustion Products
Fossil energy research program: Project status quarterly report, April 1–June 30, 1989, 15:30 (R;US)

Combustors
SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)

Depolymerization
Depolymerization of a model coal polymer, 15:23 (J;US)

Desulfurization
Genetic manipulation of acidophilic bacteria, 15:7 (R;US)

Energy Demand
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)

Energy Policy
Clean Coal Technology Deployment Act. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 879, May 18, 1987, 15:44 (B;US)
H.R. 5211: Acid Rain Abatement Act of 1988. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 11, 1988, 15:42 (B;US)

Energy Source Development
Clean Coal Technology Deployment Act. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 879, May 18, 1987, 15:44 (B;US)

Environmental Impacts
Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement, 15:26 (R;US)

Fluidized Bed Reactors
Fluidized-bed bioreactor process for the microbial solubilization of coal, 15:14 (P;US)

Fly Ash
Accumulation of alveolar macrophages in golden hamster lung after long-term exposure to coal fly-ash particles, 15:37 (R;JP;In Japanese)

Fuel Slurries
Western New York State coal-water fuel market and boiler-conversion study. Final report, 15:32 (R;US)

Molecular Structure
Chemical structures in eight US premium coals: The nature of the heteroatoms, 15:19 (R;US)

Processing
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)

Research Programs
Clean Coal Technology Program. Hearings before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, April 2 and 9, 1987, 15:1 (B;US)

Resource Development
Clean Coal Technology Program. Hearings before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, April 2 and 9, 1987, 15:1 (B;US)

Solubility
Chemical comminution and deashing of low rank coals, 15:21 (R;US)

COAL FINES
Radiant heating of small multiphase fuel droplets, 15:36 (BA;US)

COAL GASIFICATION
Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988, 15:3 (R;US)
Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989, 15:2 (R;US)
Steam conditioning of coal for synfuels production: Second quarterly report, April 1–June 30, 1987, 15:4 (R;US)
[Materials for hot gas cleanup in coal conversion and utilization systems]: Foreign trip report, May 31, 1988–June 16, 1988, 15:10 (R;US)

COAL GASIFICATION PLANTS
Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987, 15:11 (R;US)
Great Plains coal gasification project. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session, September 12, 1988, 15:13 (B;US)

COAL LIQUEFACTION
See also EXXON LIQUEFACTION PROCESS
H-COAL PROCESS
Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988–December 15, 1988, 15:6 (R;US)
Novel experimental studies for coal liquefaction: Final report, 15:5 (R;US)

COAL LIQUIDS
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)
Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988, 15:3 (R;US)
Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989, 15:2 (R;US)

COAL MINING
Proposed coal product valuation rules. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, November 16, 1987, 15:43 (B;US)
Trends in coal-mine-dust exposures for longwall miners: 1981-1987, 15:28 (R;US)

COAL RESERVES
Coal reserves. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, September 18, 1987, 15:27 (B;US)

COAL-DERIVED LIQUIDS
See COAL LIQUIDS

COAL-FIRED GAS TURBINES
Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)

COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES

COASTAL REGIONS
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Oregon) Volume 1 of 4. Final report, 15:608 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report, 15:615 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington). Volume 2 of 4. Final report, 15:605 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon). Volume 4 of 4. Final report, 15:611 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 2 of 4. Final report, 15:609 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report, 15:612 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington) Volume 4 of 4. Final report, 15:607 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report, 15:613 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington) Volume 3 of 4. Final report, 15:606 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report, 15:614 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 3 of 4. Final report, 15:610 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington). Volume 1 of 4. Final report, 15:604 (R;US)
Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis, 15:1330 (R;US)

COATINGS
See also PAINTS
PROTECTIVE COATINGS
SPRAYED COATINGS
Correlation of interface structure with adhesive strength of ion-plated TiN hard coatings, 15:820 (R;US)
Ion implantation of ceramic bearings. Final report, 1 September 1988-1 March 1989, 15:816 (R;US)

COBALT 60
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)

COBALT ALLOYS
See also COBALT BASE ALLOYS
Assessment of fouling, erosion, and corrosion of coal-fired gas turbines, 15:300 (R;US)

COBALT BASE ALLOYS
The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)

COBALT OXIDES
$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)

COGENERATION
Combined heat and power in a grain whisky distillery. A demonstration at Scottish Grain Distilleries Ltd., Port Dundas, Glasgow, 15:715 (R;GB)
Combined heat and power in a university hall of residence. A demonstration at the University of Keele, 15:687 (R;GB)
Combined heat and power using an aero-derived gas turbine. A demonstration at Smith, Stone and Knight Ltd., Nechells, Birmingham, 15:709 (R;GB)
Use of stand-by generators for combined heat and power. A demonstration at Perkin Elmer Ltd. [Llantrisant], 15:713 (R;GB)

COHERENT RADIATION
Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)

COILS (MAGNETIC)
See MAGNET COILS

COINCIDENCE SPECTROMETRY
Construction of a plunger for coincidence experiments, 15:1179 (RA;DD)

COLD NEUTRONS
Artificial intelligence search techniques for the optimization of cold source geometry, 15:224 (J;US)

COLD PLASMA
Cold nuclear fusion and muon-catalyzed fusion. January 1976-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1976-April 1989, 15:1718 (R;US)

COLLECTIVE ACCELERATORS
See also IONIZATION FRONT ACCELERATORS
Experimental studies of the laser-controlled collective ion accelerator, 15:1104 (J;US)

COLLEGES
See EDUCATIONAL FACILITIES

COLLIDING BEAMS
Real-time applications of neural nets, 15:2009 (J;US)

COLLISIONS
See also MOLECULE COLLISIONS
A global existence theorem for the nonlinear BGK equation, 15:1747 (J;US)
Darkness after the K-T impact: Effects of soot, 15:1538 (RA;US)
Data base of cross sections and reaction rates for hydrogen ion sources, 15:1703 (J;NL)
Equations of conservation laws in the interplanetary collisionfree plasma, 15:1677 (RA;BR)
Oblique impacts: Catastrophic vs. protracted effects, 15:1521 (RA;US)

COLLOIDS
See also FOAMS
GELATIN
GELS
RADIOCOLLOIDS
SOLS
Mobility of colloidal particles in the subsurface: Chemistry and hydrology of colloid-aquifer interactions: International series of interactive seminars summary report, 15:1468 (R;US)

COLOGNE SPIRITS
See ETHANOL

COLORADO
Categorization of nocturnal drainage flows within the Brush Creek Valley and the variability of sigma theta in complex terrain, 15:1244 (J;US)
Deep valley radiation and surface energy budget microclimates. Part I: Radiation, 15:1247 (J;US)
Deep valley radiation and surface energy budget microclimates. Part II: Energy Budget, 15:1245 (J;US)
Experimental design of the 1984 ASCOT field study*, 15:1281 (J;US)
Influence of external meteorology on nocturnal valley drainage winds, 15:1287 (J;US)
Low-frequency velocity and temperature fluctuations in Katabatic Valley Flows*, 15:1241 (J;US)
Mass and momentum balance in the Brush Creek drainage flow determined from single-profile data, 15:1240 (J;US)
Mean structure of the nocturnal drainage flow in a deep valley*, 15:1242 (J;US)
Measurements of turbulent heat and momentum fluxes in a mountain valley, 15:1246 (J;US)
Numerical simulation of drainage flow in Brush Creek, Colorado, 15:1249 (J;US)
Representativeness of single vertical wind profiles for determining volume flux in valleys, 15:1243 (J;US)

COLORADO RIVER BASIN
The accumulation and pooling of drainage flows in a large basin, 15:1248 (J;US)

COLUMBIUM
See NIOBIUM

COLUMNS (EXTRACTION)
See EXTRACTION COLUMNS

COLUMNS (MECHANICAL)
See MECHANICAL STRUCTURES

COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987, 15:11 (R;US)
Virginia Power's study of a Shell-based GCC [gasification combined-cycle] power plant: Final report, 15:9 (R;US)

COMBUSTION
Laser-induced fluorescence determination of temperatures in low pressure flames, 15:978 (J;US)
Solid surface combustion space shuttle experiment hardware description and ground-based test results, 15:974 (R;US)

COMBUSTION CHAMBERS
Accuracy and efficiency of a time marching approach for combustor modeling, 15:971 (RA;FR)
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)
The demonstration of monolithic and composite ceramics in aircraft gas turbine combustors, 15:818 (RA;US)
Thrust chamber thermal barrier coating techniques, 15:758 (RA;US)

COMBUSTION ENGINEERING STANDARD REACTOR
See CE STANDARD REACTOR

COMBUSTION KINETICS
Accuracy and efficiency of a time marching approach for combustor modeling, 15:971 (RA;FR)
Direct simulation of compressible reacting flows, 15:976 (RA;US)
SRB combustion dynamics analysis computer program (CDA-2). Final report, 15:973 (R;US)

COMBUSTION PRODUCTS
Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
Northeast regional biomass energy program: Progress report, July 1989–September 1989, 15:231 (R;US)

COMBUSTORS
See also FLUIDIZED-BED COMBUSTORS
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)
Coal combustion modeling: Particulate and gas phase heat transfer effects, 15:34 (B;US)

COMETS
See also HALLEY COMET
Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)
Electromagnetic waves and instabilities from cometary ion velocity shell distributions, 15:1614 (J;US)
Flood basalt eruptions, comet showers, and mass extinction events, 15:1514 (RA;US)
Late Eocene impact events recorded in deep-sea sediments, 15:1483 (RA;US)

COMMERCIAL BUILDINGS
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 3, Commercial and industrial building technologies, 15:633 (R;US)
Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)

COMMERCIAL SECTOR
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Natural gas annual 1988: Volume 1, 15:91 (R;US)

COMMODITIES
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)

COMMUNICATIONS
See also TELEPHONES
Wide-band superconductive Chirp filters, 15:982 (R;US)

COMPACT COMMISSIONS
Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:218 (B;US)

COMPACT IGNITION TOKAMAK
Safety and environmental analysis of the compact ignition tokamak, 15:1939 (R;US)
Safety implications of a graphite oxidation accident in the compact ignition tokamak device, 15:1933 (R;US)
The CIT [compact ignition tokamak] pellet injection system: Description and supporting research and development, 15:1919 (R;US)

COMPACTING
Micro-scale simulation of dynamic compaction of oxide and metal powder mixture, 15:837 (R;US)

COMPOSITE MATERIALS
Composite material systems for high temperature applications, 15:868 (RA;US)
Design assessment for metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic composite overwind, 15:979 (R;GB)
Fiber-optic sensors for composite cure analysis and lifetime nondestructive evaluation, 15:871 (R;US)
Inorganic composite materials in Japan: Status and trends, 15:890 (R;US)
Low-temperature thermal conductivity of composites: Alumina fiber/epoxy and alumina fiber/PEEK, 15:889 (R;US)
Materials Division research and technology accomplishments for FY 87 and plans for FY 88, 15:782 (R;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)

COMPOUND-NUCLEUS REACTIONS
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSION
Micron-thin Nb films recovered from Mbar shock pressures, 15:800 (R;US)
Shock compression studies of condensed matter, 15:947 (R;US)

COMPRESSOR BLADES
MATE program: erosion resistant compressor airfoil coating, volume 2. Final report, 15:829 (R;US)

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER ARCHITECTURE
Computers: Massively parallel processors. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:1993 (R;US)
Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989, 15:1070 (R;US)
J-machine: System support for actors. Memorandum report, 15:1978 (R;US)

COMPUTER CODES
See also C CODES
F CODES
N CODES
S CODES
U CODES
A rigorous pole representation of multilevel cross sections and its practical applications, 15:465 (J;US)
Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)
Materials research with ion beams. Simulation and analysis, 15:939 (R;DE;In German)
Remote procedure execution software for distributed systems, 15:2010 (J;US)
The charged particle transport module CIRCE as part of the KATACO code system, 15:1941 (R;DE)
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

COMPUTER GRAPHICS
Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)

COMPUTER LANGUAGES
See PROGRAMMING LANGUAGES

COMPUTER NETWORKS
J-machine: System support for actors. Memorandum report, 15:1978 (R;US)

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTER-AIDED DESIGN
Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988, 15:981 (R;US)

COMPUTERIZED CONTROL SYSTEMS
Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989, 15:548 (R;US)
Computer control for a particle beam accelerator, 15:1137 (J;US)
The accelerator automation application toolkit workshop presentations, 15:1095 (R;US)
The design of the CPRF [Confinement Physics Research Facility] control system, 15:1957 (R;US)

COMPUTERIZED SIMULATION
Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)

COMPUTERIZED TOMOGRAPHY
Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)
Computerized tomography: Technology and equipment. March 1988-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for March 1988-Apr 1989, 15:1404 (R;US)

COMPUTERS
See also HYPERCUBE COMPUTERS
ILLIAC COMPUTERS
MICROPROCESSORS
OPTICAL COMPUTERS
How to successfully move data between a personnel mainframe HRIS and the REGISTRAR, 15:1996 (R;US)
Summary of papers to be presented at the Eleventh computer security group conference, 15:1982 (R;US)
Wafer scale RISC [Reduced Instruction Set Computer] processor, 15:1997 (R;US)

CONCENTRATIONS (RADIONUCLIDES)
See RADIOACTIVITY

CONCRETES
See also PRESTRESSED CONCRETE
REINFORCED CONCRETE
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)

CONDENSATES
Development of a wet vapor homogeneous liquid metal MHD power system: Semi-annual report, October 1988–March 1989, 15:655 (R;US)

CONDENSERS
Targeted chlorination schedules: Final report, 15:302 (R;US)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDUCTIVITY (ELECTRIC)
See ELECTRIC CONDUCTIVITY

CONDUCTORS (ELECTRIC)
See ELECTRIC CONDUCTORS

CONSERVATION (ENERGY)
See ENERGY CONSERVATION

CONSERVATION (RESOURCE)
See RESOURCE CONSERVATION

CONSOLIDATED FUEL REPROCESSING PROGRAM
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)
Summary of experimental and calculational results from the joint USDOE/PNC criticality data development program, 15:119 (R;US)

CONSTRUCTION
Capital costs for future light water reactors with modularization/standardization, 15:380 (J;US)
The selection and use of VA/VE [Value Analysis/Value Engineering] professionals, 15:999 (R;US)

CONSTRUCTION INDUSTRY
Energy use comparison between conventional reconstruction and hot-drum mix recycling for major trunk roads. A demonstration by Kent County Council. [Maidstone], 15:710 (R;GB)

CONSUMERS POWER COMPANY MIDLAND-1
See MIDLAND-1 REACTOR

CONSUMERS POWER COMPANY MIDLAND-2
See MIDLAND-2 REACTOR

CONTACT RADIOTHERAPY
See RADIOTHERAPY
CONTACTORS
See SWITCHES
CONTACTS (ELECTRIC)
See ELECTRIC CONTACTS
CONTAINMENT
See also CONTAINMENT SYSTEMS
OIL POLLUTION CONTAINMENT
A critique of three methodologies for estimating the probability of containment failure due to steam explosions, 15:539 (J;US)
Development of an accident management expert system for containment assessment, 15:508 (BA;US)
Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988, 15:160 (R;US)
CONTAINMENT SYSTEMS
Evaluation of the consequences of containment bypass scenarios, 15:532 (J;US)
Passive containment cooling for an advanced PWR, 15:373 (J;US)
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
CONTAMINATION (INTERNAL)
See RADIONUCLIDE KINETICS
CONTROL THEORY
Survey of adaptive control theory and its applications, 15:322 (R;JP;In Japanese)
CONTROL THEORY (REACTOR)
See REACTOR KINETICS
CONVECTION
Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)
COOLANT-FUEL INTERACTIONS
See FUEL-COOLANT INTERACTIONS
COOLERS
See HEAT EXCHANGERS
COOLING PONDS
Control of clarity and radioactivity in fuel storage basin water, 15:136 (RA;US)
COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS
COORDINATED RESEARCH PROGRAMS
See also CONSOLIDATED FUEL REPROCESSING PROGRAM
Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)
COORDINATES
A study of the effect of temperature on the measurement of a hemishell by the development coordinate measuring machine, 15:1001 (R;US)
COPOLYMERS
Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)
COPPER
Electroplating of copper. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:795 (R;US)
Epitaxial growth of body-centered-tetragonal copper, 15:815 (J;US)
Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)
New measurement of the production polarization and magnetic moment of the Ξ^- hyperon, 15:1728 (J;US)
Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries, 15:199 (P;US)
COPPER ALLOYS
See also COPPER BASE ALLOYS
Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)
COPPER BASE ALLOYS
Magnetic behavior of $Ce(Cu_{1-x}Ag_x)_6$, 15:809 (J;US)
COPPER COMPOUNDS
See also COPPER OXIDES
CUPRATES
Metal oxide films from carboxylate precursors, 15:817 (R;US)
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
COPPER ISOTOPES
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
COPPER OXIDES
Antiferromagnetism
Antiferromagnetic resonance in La_2CuO_{4+y}, 15:858 (J;US)
Band Theory
MX chains: 1-D analog of CuO planes?, 15:1872 (R;US)
Charged-Particle Transport
Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy, 15:1870 (R;US)
Critical Current
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Critical Field
Angular dependence of the upper critical field of $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:864 (J;US)
Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds, 15:853 (J;US)
Crystallography
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
Diamagnetism
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Electric Conductivity
Temperature, frequency, and rf field dependence of the surface resistance of polycrystalline $YBa_2Cu_3O_{7-x}$, 15:859 (J;US)
Electrical Properties
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Electron Transfer
Charge transfer and bond lengths in $YBa_2Cu_{3-x}M_xO_{6+y}$, 15:1869 (R;US)
Electronic Structure
Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)
Fabrication
Superconducting film fabrication by the sol-gel process, 15:825 (R;US)
Magnetic Properties
Magnetic ordering in $La_2Cu_{1-x}Zn_xO_{4-y}$, 15:865 (J;US)
Neutron scattering studies of magnetic correlations in the layered cuprates, 15:1868 (R;US)
Neutron scattering study of the magnetic excitations in metallic and superconducting $La_{2-x}Sr_xCuO_{4-y}$, 15:856 (J;US)
Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report, 15:879 (R;US)
Rotational magnetic processes in $YB_2Cu_3O_7$, 15:875 (R;US)
Spin dynamics in the two-dimensional quantum antiferromagnet La_2CuO_4, 15:855 (J;US)
Mechanical Properties
Application of neutron diffraction to the characterization of residual thermal strains in $YBa_2Cu_3O_{7-\delta}$/Ag, 15:849 (J;US)
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)

Physical Properties
Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$, 15:851 (J;US)
Physical Radiation Effects
Environmental effects on luminescence yield of superconducting $YBa_2Cu_3O_x$, 15:842 (J;US)
Spin Waves
Neutron scattering study of magnetic excitations in $YBa_2Cu_3O_{6+x}$, 15:852 (J;US)
Superconductivity
Bulk superconductivity above 30 K in T^*-phase compounds, 15:861 (J;US)
Characterization and superconducting properties of phases in the Bi-Sr-Cu-O system, 15:844 (J;US)
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system, 15:862 (J;US)
$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)
Synthesis
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Twinning
Formation of coherent twins in $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:843 (J;US)
Very High Pressure
Pressure dependence of the Cu magnetic order in $RBa_2Cu_3O_{6+x}$, 15:860 (J;US)

CORES (REACTOR)
See REACTOR CORES

CORONA (SOLAR)
See SOLAR CORONA

COSMIC DUST
Interaction of dust grains with space plasmas, 15:1676 (RA;BR)

COSMIC NEUTRINOS
Model dependence of astrophysical lower bounds on the neutrino mass, 15:1612 (J;US)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
See also COSMIC NEUTRINOS
SECONDARY COSMIC RADIATION
Proceedings of the 1. Latin-American Conference on Space Geophysics, 15:1554 (R;BR)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Studies of the cosmic ray penumbra. Final report, 9 September 1980-30 September 1985, 15:1548 (R;US)

COSMIC RAY DETECTION
Short period variation of cosmic ray intensity observed in the stratosphere, 15:1673 (RA;BR)

COSMIC RAY FLUX
Observations of high-energy electrons in the stratosphere, 15:1674 (RA;BR)

COSMIC RAY PROPAGATION
Perspectives of electron-capture and alternative methods for dianosis of particle sources and acceleration processes, 15:1896 (RA;BR)

COSMOGONY
See COSMOLOGY

COSMOLOGY
Great attractor really a great wall, 15:1570 (R;US)
Solitosynthesis: Cosmological evolution of non-topological solitons, 15:1580 (R;US)

COSMOS
See UNIVERSE

COST
See also CAPITALIZED COST
How far can the world get on energy efficiency alone?, 15:588 (R;US)

COUNTERS (RADIATION)
See RADIATION DETECTORS

CP INVARIANCE
How well do we know the Kobayashi-Maskawa matrix?, 15:1753 (J;US)

CRATERS
Calvin 28 cryptoexplosive disturbance, Cass County, Michigan: Evidence for impact origin, 15:1503 (RA;US)
Crater size estimates for large-body terrestrial impact, 15:1519 (RA;US)
Karskiy craters are the probable records of catastrophe at the Cretaceous-Tertiary boundary, 15:1494 (RA;US)
Manson impact structure, a possible site for a Cretaceous-Tertiary (K-T) boundary impact, 15:1486 (RA;US)
Report on an international workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure, 15:1517 (RA;US)

CRETACEOUS PERIOD
Impact wave deposits provide new constraints on the location of the K/T boundary impact, 15:1488 (RA;US)
Macrofossil extinction patterns at Bay of Biscay Cretaceous-Tertiary boundary sections, 15:1534 (RA;US)
Plant microfossil record of the terminal Cretaceous event in the western United States and Canada, 15:1507 (RA;US)
Selective extinction of marine plankton at the end of the Mesozoic era: The fossil and stable isotope record, 15:1495 (RA;US)

CRITICAL FREQUENCY
Semiempirical model for calculating the critical frequency of F region on Concepcion, Chile, 15:1802 (RA;BR;In Spanish)

CRITICALITY
A comparison between criticality analyses for unreflected systems by Monte Carlo codes MCNP and MONK6A, 15:1006 (J;US)
A k_{eff} search and optimization using noisy differentials, 15:1005 (J;US)
A reassessment of criticality safety in the Sellafield separation plant, 15:211 (J;US)
Applications of probabilistic risk assessment to criticality safety at the Savannah River Site, 15:507 (R;US)
Californium-252-source-driven noise analysis measurements for six interacting safe bottles of aqueous uranyl nitrate, 15:1007 (J;US)
Demonstration of criticality safety for the modified TN-REG and TN-BRP transport/storage casks, 15:986 (R;US)
GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor, 15:479 (J;US)
Summary of experimental and calculational results from the joint USDOE/PNC criticality data development program, 15:119 (R;US)
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)

CRITICALITY ACCIDENTS
See CRITICALITY
RADIATION ACCIDENTS

CROPPING SYSTEMS
See CULTIVATION TECHNIQUES

CROSS SECTIONS
The LAW [Library to Analyze Waste] library: A multigroup cross section library for use in radioactive waste analysis calculations, 15:141 (R;US)
Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989, 15:1887 (R;US)

CROSSED BEAMS
See COLLIDING BEAMS

CROSSFLOW COOLING TOWERS
See CROSSFLOW SYSTEMS

CROSSFLOW SYSTEMS
Doubly-fluted tubes and enhanced tubes in confined crossflow. Annual report, August 1987-July 1988, 15:1057 (R;US)

CRUDE OIL
See PETROLEUM

CRUSTACEANS
Macrofossil extinction patterns at Bay of Biscay Cretaceous-Tertiary boundary sections, 15:1534 (RA;US)
Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)
CRYOGENIC FLUIDS
COLD-SAT: An orbital cryogenic hydrogen technology experiment, 15:990 (R;US)
Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)
CRYOGENICS
Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989, 15:984 (R;US)
Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989, 15:980 (R;US)
CRYOGENS
See CRYOGENIC FLUIDS
CRYOPUMPS
Cryogenic turbopump bearing materials, 15:985 (RA;US)
Fiber reinforced superalloys for rocket engines, 15:759 (RA;US)
Low temperature cryoprobe, 15:1015 (P;US)
CRYSTAL DEFECTS
Development of new techniques for the characterization of crystals and their growth solutions: Center director's discretionary fund. Final report, 15:946 (R;US)
CRYSTAL GROWTH
Development of new techniques for the characterization of crystals and their growth solutions: Center director's discretionary fund. Final report, 15:946 (R;US)
CRYSTALS
Model for a decorated twin boundary in ferroelastic martensites, 15:1867 (J;US)
Performance of a directly water-cooled silicon crystal for use in high-power synchrotron radiation applications, 15:1105 (R;US)
CUBIC LATTICES
Geometrical aspects of the frustration in the cubic phases of lyotropic liquid crystals, 15:1382 (J;US)
CULTIVATION TECHNIQUES
Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)
CULTURES (CELLS)
See CELL CULTURES
CUPRATES
Metal oxide films from carboxylate precursors, 15:817 (R;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)
CURIUM
Magnetic behavior of curium and americium-curium alloys, 15:768 (R;US)
CURIUM ALLOYS
Magnetic behavior of curium and americium-curium alloys, 15:768 (R;US)
[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)
CURIUM COMPLEXES
Laser-induced flourescence studies of Cm^{3}+ complexes in solution, 15:873 (R;US)
CURRENT (ALTERNATING)
See ALTERNATING CURRENT
CURRENT (DIRECT)
See DIRECT CURRENT
CURRENTS (ELECTRIC)
See ELECTRIC CURRENTS

D

D* PLUS RESONANCES
See BARYONS
D* ZERO RESONANCES
See BARYONS
D*RESONANCES
See BARYONS
DAMPING
Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator, 15:313 (R;JP;In Japanese)
DAMS
Behaviors and scale effect of wave reflection and run-up on armored breakwater, 15:1089 (R;JP;In Japanese)
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)
DARK MATTER
See NONLUMINOUS MATTER
DATA ACQUISITION
Development of the software of the data taking system SOS for the SAPHIR experiment, 15:1981 (R;DE;In German)
DATA ACQUISITION SYSTEMS
TA705 Data Retention Chassis operating manual, 15:1075 (R;US)
The development of a standard format for accelerator data analysis, 15:1127 (R;US)
DATA BASE MANAGEMENT
Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)
DATA PROCESSING
See also DISTRIBUTED DATA PROCESSING
Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)
Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR, 15:1156 (R;DE;In German)
Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring, 15:1158 (R;DE;In German)
Three-dimensional survey techniques for large detector systems, 15:1204 (J;NL)
DATA-FLOW PROCESSING
Token relabeling in a tagged token data-flow architecture, 15:2007 (J;US)
DAYGLOW
See AIRGLOW
DECALSO
See ION EXCHANGE MATERIALS
DECIMETER WAVE RADIATION (1-3 DM)
See RADIOWAVE RADIATION
DECIMETER WAVE RADIATION (3-10DM)
See RADIOWAVE RADIATION
DECOMMISSIONING
See also REACTOR DECOMMISSIONING
Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)
DECONTAMINATION
Methodology for the evaluation of decontaminant drugs at in vitro systems., 15:1433 (RA;AR;In Spanish)
DECONTAMINATION FACTOR
See DECONTAMINATION
DEFORESTATION
Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations, 15:1257 (R;US)
DEFORMATION
Approximate methods for dynamic plastic deformation of structures, 15:766 (R;US)
Constitutive modelling in the range of inelastic deformations, 15:771 (R;FR)
Simulation of mechanical deformation via nonequilibrium molecular dynamics, 15:1067 (R;US)
DEFORMED NUCLEI
On the influence of the quadrupole pairing on the energies of the two-quasiparticle states in deformed nuclei, 15:1803 (R;SU)
Reflection asymmetric shapes in nuclei, 15:1799 (R;US)
DELAYED NEUTRON ANALYSIS
Theoretical analysis of reactivity measurement with the ^{252}CF source ratio method, 15:423 (R;US)

DELAYED NEUTRONS
ENDF/B-VI six-group delayed neutron data, 15:1798 (R;US)
ENDF/VI six-group delayed neutron data, 15:1797 (R;US)
DENSITY (ELECTRON)
See ELECTRON DENSITY
DENTISTRY
Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)
DEOXYCYTIDINURIA
See URINE
DEOXYPENTOSE NUCLEIC ACID
See DNA
DEOXYRIBONUCLEIC ACID
See DNA
DEPLETION (NUCLEAR FUELS)
See BURNUP
DEPOSITION
Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea, 15:1258 (R;DE)
DESERTRON
See SUPERCONDUCTING SUPER COLLIDER
DESIGN
A blanket design, apparatus, and fabrication techniques for the mass production of multilayer insulation blankets for the Superconducting Super Collider, 15:1124 (R;US)
DESIGN BASIS ACCIDENTS
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
DESOXYRIBONUCLEIC ACID
See DNA
DETECTION
See also NUCLEAR EXPLOSION DETECTION
RADIATION DETECTION
Development of laser excited atomic fluorescence and ionization spectrometric methods: Progress report, January 1, 1989–October 1, 1989, 15:918 (R;US)
DETECTION (NUCLEAR EXPLOSIONS)
See NUCLEAR EXPLOSION DETECTION
DETECTION (RADIATION)
See RADIATION DETECTION
DETECTORS (RADIATION)
See RADIATION DETECTORS
DEUTERIDES
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)
DEUTERIUM
Hydrogen dissolution in and relesease from nonmetals, 15:838 (J;NL)
Reaction rates of $H(H_2)$, $D(H_2)$, and $H(D_2)$ van der Waals molecules and the threshold behavior of the bimolecular gas-phase rate coefficient, 15:952 (J;US)
DEUTERIUM TARGET
Fortran code for the calculation of 'realistic' distributions of neutrons produced in hydrogen-isotope reactions, 15:1831 (RA;DD)
DEUTERON REACTIONS
New comparisons of the coupled-channel model with elastic deuteron form factors, 15:1827 (J;US)
Radiative capture of tensor and vector polarized deuterons by ^3H at 400 keV, 15:1784 (J;US)
DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS
DEVELOPING COUNTRIES
Environmental management and economic development, 15:625 (R;US)
DEVICES
See EQUIPMENT
DEW POINT
Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus, 15:1061 (J;US)
DIABLO CANYON-1 REACTOR
Pilot RCM application to the Diablo Canyon main stream system, 15:371 (J;US)
DIABLO CANYON-2 REACTOR
Pilot RCM application to the Diablo Canyon main stream system, 15:371 (J;US)
DIAMOND DRILLING EQUIPMENT
See DRILLING EQUIPMENT
DIBARYON RESONANCES
See DIBARYONS
DIBARYONS
Baryon-baryon interaction and dibaryonic systems. Review and perspectives, 15:1725 (R;DE)
Linear momentum transfer in the reaction of 64–269 MeV ^3He with ^{238}U, 15:1821 (J;US)
DIESEL ENGINES
Calculation of steady and transient torsional vibrations of marine diesels of different system configurations and geometry, 15:741 (R;DE;In German)
DIESEL FUELS
Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:79 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Impacts of ultra low sulfur diesel fuel production on Navy fuel availability, 15:78 (R;US)
DIESEL OIL (FRACTION)
See DIESEL FUELS
DIFFRACTION (X-RAY)
See X-RAY DIFFRACTION
DIFFUSION
Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)
DIGESTER GAS
See METHANE
DIGITAL SYSTEMS
SAND DEVIL: A digital video link for telemetry applications, 15:1216 (R;US)
DIODE TRANSISTORS
See TRANSISTORS
DIOXIN
Calibration and quality assurance for dioxin analysis, 15:1447 (R;GB)
Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
Technologies for reducing dioxin in the manufacture of bleached wood pulp. Background paper, 15:738 (R;US)
DIRECT CURRENT
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
DISARMAMENT
See ARMS CONTROL
DISCHARGES (WASTES)
See WASTE DISPOSAL
DISCHARGING (REACTOR)
See REACTOR FUELING
DISCRETE ORDINATE METHOD
The weighted diamond-difference form of nodal transport methods, 15:429 (J;US)
DISCRETE ORDINATES
See DISCRETE ORDINATE METHOD
DISEASES
See also NEOPLASMS
RESPIRATORY SYSTEM DISEASES
UROGENITAL SYSTEM DISEASES
Agency for toxic substances and disease registry: Annual report for FY 1987, October 1, 1986–September 30, 1987, 15:1442 (R;US)
DISINTEGRATION (NUCLEAR PARTICLE)
See ANNIHILATION
DISPERSANTS (CHEMICAL)
See SURFACTANTS
DISPERSE SYSTEMS
See DISPERSIONS

DISPERSED STORAGE AND GENERATION
Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
DISPERSIONS
See also COLLOIDS
Simulation of atmospheric dispersion of radioactivity from the Chernobyl accident, 15:1437 (R;US)
DISPERSIVE ION WAVES
See ION PLASMA WAVES
DISPOSAL (WASTES)
See WASTE DISPOSAL
DISPOSAL WELLS
The effect of liner hydraulic conductivity on disposal cell performance, 15:188 (J;US)
DISPROPORTIONATION
See OXIDATION
DISSOLVED GASES
Application of an industrial gas supply system to a hydrogen water chemistry installation, 15:353 (J;US)
DISSOLVED OXYGEN
See DISSOLVED GASES
OXYGEN
DISTILLATION EQUIPMENT
Retrofitting of structured packing in an atmospheric distillation column. A demonstration at Phillips Petroleum Ltd., North Tees, 15:61 (R;GB)
DISTRIBUTED DATA PROCESSING
Remote procedure execution software for distributed systems, 15:2010 (J;US)
DNA
Computational approaches to discovering semantics in molecular biology, 15:2006 (J;US)
Directed mutagenesis indicates that the donor to P^{+}_{680} in photosystem II is tyrosine-161 of the D1 polypeptide, 15:1384 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 3. Effect of electrical field shape, 15:1387 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 2. Effect of pulse time and electric field strength and implications for models of the separation process, 15:1386 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 4. Influence of DNA topology, 15:1388 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 1. DNA size standards and the effect of agarose and temperature, 15:1385 (J;US)
Model for how type I restriction enzymes select cleavage sites in DNA, 15:1381 (J;US)
Physical and chemical interactions in irradiated water containing DNA, 15:1423 (R;US)
DNA ADDUCTS
Conformations of DNA modified by aromatic amines: Minimized semiempirical potential energy calculations and model building, 15:1375 (BA;US)
DNA SEQUENCING
Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)
DOMESTIC WASTES
See MUNICIPAL WASTES
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE EQUIVALENTS
On the influence of the exposure model on organ doses, 15:1841 (J;US)
The effect of gender and remainder on effective dose equivalent, 15:1843 (J;US)
DOSEMETERS
See also BIOLOGICAL DOSEMETERS
BRAGG GRAY CHAMBERS
Calibration of individual neutron monitors in terms of H_e and the new ICRU dose-equivalent quantities, 15:1845 (J;US)
Dose equivalent and phantoms in conventional calibration practice, 15:1844 (J;US)
DOSIMETERS
See DOSEMETERS
DOSIMETRY
See also ION DOSIMETRY
PERSONNEL DOSIMETRY
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry, 15:352 (J;US)
Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)
DRAG EFFECT
See ELECTROPHORESIS
DREDGE SPOIL
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
DRIFT (PLASMA)
See PLASMA DRIFT
DRIFT CHAMBERS
Development and construction of a monitoring system for the central drift chamber of the SAPHIR detector, 15:1155 (R;DE;In German)
Pattern recognition and resolution of the left/right ambiguities in the central drift chamber of SAPHIR, 15:1156 (R;DE;In German)
Recognition and reconstruction of charged particles in SAPHIR at the ELSA ring, 15:1158 (R;DE;In German)
Track recognition and track reconstruction in the forward drift chamber of SAPHIR, 15:1159 (R;DE;In German)
DRILL SHIPS
See SHIPS
DRILLING EQUIPMENT
Cemented NbC-Co for geothermal drilling applications: Final report, 15:298 (R;US)
DRINKING WATER
Methods for the determination of organic compounds in drinking water, 15:1337 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Pharmacokinetics in risk assessment: drinking water and health. Volume 8, 15:1445 (R;US)
Removal of uranium from drinking water by conventional treatment methods, 15:1347 (R;US)
Trace substances present as chlorination by-products in drinking and process waters, 15:1342 (J;US)
DROPLETS
Laser droplet heating: fast and slow heating regimes, 15:1250 (J;US)
DRUGS
See also RADIOPHARMACEUTICALS
RADIOSENSITIZERS
Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)
DRY DEPOSITION
See DEPOSITION
DRYING
Straw as a fuel for chalk drying. A demonstration at Needham Chalks Ltd. [Ipswich], 15:232 (R;GB)
DUCTS
Inspection of contaminated hot cell ductwork, 15:991 (R;US)
DUOPLASMATRONS
Data base of cross sections and reaction rates for hydrogen ion sources, 15:1703 (J;NL)
DUSTS
See also COSMIC DUST

Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
Respirable quartz exposure at silica flour producers, 1975-1986, 15:1269 (R;US)
Trends in coal-mine-dust exposures for longwall miners: 1981-1987, 15:28 (R;US)

DYE LASERS
Comparison of laser models. Progress report, period ended 15 May 1989, 15:1033 (R;US)
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)

DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM

DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM

DYNAMIC PROGRAMMING
Optimal preventive maintenance of a nuclear plant subsystem using dynamic programming, 15:411 (J;US)

DYSPROSIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)

E

E LAYER
See E REGION

E REGION
See also SPORADIC E
Equatorial F region electrodynamics, 15:1657 (RA;BR)
Ionospheric electron temperature rocket measurements with langmuir probe over Natal, Brazil, in 1985, 15:1897 (RA;BR)
Modern problems in physics of variations of the ionosphere at the altitudes 100-200 Km, 15:1628 (RA;BR)

EARTH ATMOSPHERE
See also EARTH MAGNETOSPHERE
IONOSPHERE
MESOSPHERE
STRATOSPHERE
THERMOSPHERE
Assessment of the atmospheric impact of volcanic eruptions, 15:1524 (RA;US)
Global environmental effects of impact-generated aerosols: Results from a general circulation model, 15:1238 (RA;US)
Global problems in solar-terrestrial research, 15:1635 (RA;BR)
On the excitation mechanism of oxygen-related emissions in the airglow and aurora, 15:1640 (RA;BR)
Proceedings of the 1. Latin-American Conference on Space Geophysics, 15:1554 (R;BR)
Sampling and analysis protocols and project description for the Integrated Forest Study, 15:1262 (R;US)
Upper atmospheric research in Brazil, 15:1621 (RA;BR)

EARTH CRUST
Evidence for a single impact at the Cretaceous-Tertiary boundary from trace elements, 15:1480 (RA;US)
Extended Cretaceous-Tertiary (K/T) stable isotope record. Implications for paleoclimate and the nature of the K/T boundary event, 15:1478 (RA;US)
Shocked quartz and more: Impact signatures in K-T boundary clays and claystones, 15:1477 (RA;US)

EARTH MAGNETOSPHERE
Boundary-layer dynamics in the description of magnetospheric substorms, 15:1541 (R;US)
Effects of corotation electric field on the dynamic of energetic particles in an asymetric planetary magnetic field, 15:1567 (RA;BR)
Electromagnetic instability below the proton gyrofrequency in large β multicomponent plasmas, 15:1682 (RA;BR)
Ion-ion acoustic waves versus electron-ion acoustic waves, 15:1899 (RA;BR)
Ionospheric absorption cosmic noise observations in Antartic, 15:1658 (RA;BR)
MHD simulation in space plasma, 15:1685 (RA;BR)
Research in magnetospheric physics at INPE: results and perspectives, 15:1627 (RA;BR)
Wave emissions from planetary magnetospheres. Final report, 1 June 1985-31 May 1989, 15:1579 (R;US)

EARTH PLANET
Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)
Debate over the Cretaceous-Tertiary boundary, 15:1474 (RA;US)
Global Cretaceous-Tertiary fire: Biomass or fossil carbon, 15:1482 (RA;US)
Global catastrophes in earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality, 15:1473 (R;US)
Global environmental effects of impact-generated aerosols: Results from a general circulation model, 15:1238 (RA;US)
Late Wenlock (middle Silurian) bio-events: Caused by volatile boloid impact/s, 15:1476 (RA;US)
Proterozoic Bushveld-Vredefort catastrophe: Possible causes and consequences, 15:1479 (RA;US)
The 3-D world modeling with updating capability based on combinatorial geometry, 15:1990 (RA;US)
The delineation and interpretation of the earth's gravity field. Annual progress report, 1 June 1988-31 May 1989, 15:1585 (R;US)

EBR-2 REACTOR
Irradiation performance of metallic fuels, 15:392 (R;US)

ECONOMIC GROWTH
Environmental boundaries to energy development, 15:616 (R;US)

EDS LIQUEFACTION
See EXXON LIQUEFACTION PROCESS

EDUCATIONAL FACILITIES
See also SCHOOL BUILDINGS
[Bioproductivity and photosynthesis]: Foreign trip report, September 21–30, 1989, 15:243 (R;US)

EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS

EFFLUENTS (LIQUID)
See LIQUID WASTES

EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS

EFFUSION
See DIFFUSION

EIKONAL APPROXIMATION
Constituent approach to high energy elastic scattering of hadrons, 15:1724 (R;FR)

ELASTOMERS
Predictive aging of elastomers in air: The importance of understanding diffusion-limited oxidation effects, 15:896 (R;US)

ELECTRIC BATTERIES
See also LEAD-ACID BATTERIES
METAL-GAS BATTERIES
METAL-NONMETAL BATTERIES
THERMAL BATTERIES
A new concept for high-cycle-life LEO: Rechargeable MnO_2-hydrogen, 15:556 (RA;US)
A survey of advanced battery systems for space applications, 15:552 (RA;US)
Basic program for desktop computers to control battery-cycling experiments. Technical memo. June 1988-June 1989, 15:548 (R;US)
Effects of the organic electrolyte solution on rechargeability of Li electrode, 15:565 (BA;US)
High energy density lithium niobium triselenide cells, 15:573 (BA;US)
International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings, 15:564 (B;US)
Physicochemical factors influencing LiAsF6 reactivity, 15:568 (BA;US)
Reserve lithium-thionyl chloride battery for missile applications, 15:574 (BA;US)

ELECTRIC CABLES
See also SUPERCONDUCTING CABLES
Accelerated life tests on 11 kV and 33 kV MIND paper cables in the laboratory, 15:326 (R;GB)
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
Radiation effects on power cables for nuclear power plants, 15:454 (J;US)
Remote location of faulted 11 kV cable sections, 15:325 (R;GB)
ELECTRIC CONDENSERS
See CAPACITORS
ELECTRIC CONDUCTIVITY
See also MAGNETORESISTANCE
SUPERCONDUCTIVITY
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
ELECTRIC CONDUCTORS
Compact short-wavelength free-electron laser, 15:1041 (J;US)
ELECTRIC CONTACTORS
See SWITCHES
ELECTRIC CONTACTS
Thermally stable metal/GaAs contacts, 15:878 (R;US)
ELECTRIC CURRENTS
See also ALTERNATING CURRENT
DIRECT CURRENT
ELECTROJETS
Multisolution load flow and index of voltage stability, 15:317 (R;JP;In Japanese)
ELECTRIC DIPOLE MOMENTS
A proposed method of measuring the electric-dipole moment of the neutron by ultracold neutron interferometry, 15:1779 (R;US)
ELECTRIC FIELDS
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 1, User's manual, 15:309 (R;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 3. Effect of electrical field shape, 15:1387 (J;US)
Periodicities in the atmospheric electric field measured at the South Atlantic geomagnetic Anomaly, 15:1680 (RA;BR)
ELECTRIC GENERATORS
See also SUPERCONDUCTING GENERATORS
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
Rotor instability due to a gear coupling connected to a bearingless sun wheel of a planetary gear, 15:304 (RA;US)
ELECTRIC POTENTIAL
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)
Multisolution load flow and index of voltage stability, 15:317 (R;JP;In Japanese)
ELECTRIC POWER
See also HYDROELECTRIC POWER
Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989, 15:99 (B;US)
ELECTRIC POWER INDUSTRY
Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)
ELECTRIC POWER SUBSTATIONS
See POWER SUBSTATIONS
ELECTRIC POWER SYSTEMS
See POWER SYSTEMS
ELECTRIC RESISTIVITY
See ELECTRIC CONDUCTIVITY
ELECTRIC SWITCHES
See SWITCHES
ELECTRIC UTILITIES
Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report, 15:651 (R;US)
Monthly energy review, July 1989, 15:648 (R;US)
Power system planning and engineering–research needs and priorities: Proceedings, 15:649 (R;US)
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)
ELECTRICAL BREAKDOWN
See ELECTRICAL FAULTS
ELECTRICAL CONDUCTIVITY
See ELECTRIC CONDUCTIVITY
ELECTRICAL EQUIPMENT
See also CAPACITORS
CIRCUIT BREAKERS
ELECTRIC CONTACTS
ELECTRICAL INSULATORS
LIGHTNING ARRESTERS
SWITCHES
TRANSFORMERS
Condition monitoring of 132 kv bushings, 15:327 (R;GB)
ELECTRICAL FAULTS
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
ELECTRICAL INSULATION
Electrical insulation system for the shell-vacuum vessel and poloidal field gap in the ZTH machine, 15:1949 (R;US)
Electrical-insulating-materials deterioration. January 1970-July 1989 (Citations from the COMPENDEX data base). Report for January 1970-July 1989, 15:891 (R;US)
ELECTRICAL INSULATORS
Electrical breakdown in vacuum: Working group report, 15:997 (R;US)
Extending the service life of 15KV polyethylene URD cable using silicone liquid, 15:307 (J;US)
ELECTRICAL RESISTANCE
See ELECTRIC CONDUCTIVITY
ELECTRICAL RESISTIVITY
See ELECTRIC CONDUCTIVITY
ELECTRICITY
Research for electric energy systems: An annual report, 15:331 (R;US)
ELECTRO-OPTICAL EFFECTS
Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)
ELECTROCATALYSTS
Non-noble electrocatalysts for alkaline fuel cells, 15:664 (RA;US)
ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
The electrochemical generation of useful chemical species from lunar materials, 15:555 (RA;US)
ELECTRODES
See also CATHODES
Performance of lightweight nickel electrodes, 15:579 (BA;US)
Specification and characteristics of ion selective electrode for uranium (VI), 15:923 (R;BR;In Portuguese)
ELECTROJETS
Distributed currents in the equatorial ionosphere over South American and Indian sub-continents: a comparison, 15:1661 (RA;BR)
Mode of variation of the electrojet width with current intensity during the solstices, 15:1662 (RA;BR)
Morphology of EEJ: - Possible horizontal and vertical profiles from satellites and rockets data of equatorial electrojet, 15:1664 (RA;BR)
Overhead configurations of Equatorial Electrojet (EEJ) at different seasons, 15:1663 (RA;BR)
Simultaneous rocket and radar measurements of plasma instabilities in the Equatorial electrojet, 15:1634 (RA;BR)
ELECTROLYTE TILES
See MATRIX MATERIALS
ELECTROLYTES
See also SOLID ELECTROLYTES
Evaluation of mixed solvent electrolytes for ambient temperature secondary lithium cells, 15:567 (BA;US)

ELECTROMAGNETIC FIELDS
Effects of spatial attention on the visual-evoked neuromagnetic response, 15:1402 (R;US)

ELECTROMAGNETIC FILTERS
Wide-band superconductive Chirp filters, 15:982 (R;US)

ELECTROMAGNETIC PULSES
Characteristics of electromagnetic wave forms with lightning in winter season, 15:1235 (R;JP;In Japanese)

ELECTROMAGNETIC RADIATION
See also COHERENT RADIATION
ELECTROMAGNETIC PULSES
GAMMA RADIATION
INFRARED RADIATION
LASER RADIATION
RADIOWAVE RADIATION
ULTRALOW FREQUENCY RADIATION
ULTRAVIOLET RADIATION
VISIBLE RADIATION
X RADIATION
Hypercube matrix computation task. Report, 1986-1988, 15:1830 (R;US)

ELECTROMAGNETIC WAVES
See ELECTROMAGNETIC RADIATION

ELECTROMAGNETISM
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)

ELECTROMIGRATION
See ELECTROPHORESIS

ELECTRON ACCEPTOR
See ELECTRONS

ELECTRON BEAM INJECTION
The injection system of the stretcher ring ELSA, 15:1108 (R;DE;In German)

ELECTRON BEAMS
Downstream ray tracing in beam-optics codes. Final report, September 1984-September 1987, 15:1100 (R;US)
High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim), 15:1022 (R;US)
Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988, 15:1021 (R;US)
Self-field-induced chaotic electron motion in free electron lasers, 15:1036 (R;US)
Self-focusing of laser beams in magnetized relativistic electron beams, 15:1909 (BA;US)
Spaced-based free electron laser, 15:1686 (RA;BR)
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)
Two-beam BGK solution in an inhonogeneous magnetic field, 15:1678 (RA;BR)

ELECTRON CONFIGURATION (ATOMS)
See ELECTRONIC STRUCTURE

ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS

ELECTRON DENSITY
Electron density decrease during geomagnetic storms observed by means of two different techniques, 15:1656 (RA;BR)
Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)
Ionospheric responses over the brazilian territory to the magnetic storm of february 7-10,1986, 15:1665 (RA;BR)
VLF transmissions phenomena observed in the Antarctic peninsula, 15:1666 (RA;BR)

ELECTRON DONOR
See ELECTRONS

ELECTRON MICROSCOPY
Analytical electron microscopy of leached nuclear waste glasses, 15:139 (R;US)
[Future of electron microscopy]: Foreign trip report, September 11–30, 1989, 15:792 (R;US)

ELECTRON PAIRS
Mass and transverse momentum dependence of the dielectron yield in *p*-Be collisions at 4.9 GeV, 15:1787 (J;US)

ELECTRON PRECIPITATION
Mesospheric ozone depletion due to electron precipitation at the South Atlantic Magnetic Anomaly during geomagnetic storms, 15:1684 (RA;BR)

ELECTRON REACTIONS
Quasielastic (e,e') sum rule saturation, 15:1820 (J;US)
Relations between polarized-proton-nucleus and unpolarized-transverse-electron-nucleus scattering and applications, 15:1817 (J;US)

ELECTRON SPECTROSCOPY
Out-of-plane spectrometry: Why and how, 15:1205 (J;NL)

ELECTRON-ELECTRON COUPLING
Lanczos diagonalizations of the 1-D Peierls-Hubbard model, 15:1852 (R;US)

ELECTRON-NUCLEON INTERACTIONS
Testing QCD with milli-TeV electrons, 15:1742 (J;NL)

ELECTRON-PHONON COUPLING
Lanczos diagonalizations of the 1-D Peierls-Hubbard model, 15:1852 (R;US)

ELECTRON-POSITRON INTERACTIONS
A new νanti ν + multiphoton generator derived from KORALZ, 15:1739 (R;DE)
Beam-polarization phenomena in high-energy e^+e^- collider physics, 15:1748 (J;US)
Measurement of α_s from hadron jets in e^+e^- annihilation at $\sqrt{s}$ of 29 GeV, 15:1727 (J;US)
New-quark and -lepton production at high-energy e^+e^- colliders, 15:1749 (J;US)

ELECTRONIC CIRCUITS
Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)

ELECTRONIC DATA PROCESSING
See DATA PROCESSING

ELECTRONIC EQUIPMENT
See also MICROWAVE EQUIPMENT
OSCILLATORS
POWER SUPPLIES
RESONATORS
High-temperature electronics available now and plans for the future, 15:1076 (R;US)
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)

ELECTRONIC STRUCTURE
See also L SHELL
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)

ELECTRONS
Absolute stability in a low density electron heat conducting plasma in strong magnetic fields, 15:1900 (RA;BR)
Equations of conservation laws in the interplanetary collisionfree plasma, 15:1677 (RA;BR)
Introduction to dissociative recombination, 15:1694 (R;US)
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)

ELECTROPHORESIS
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 4. Influence of DNA topology, 15:1388 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 1. DNA size standards and the effect of agarose and temperature, 15:1385 (J;US)
High-resolution separation and accurate size determination in pulsed-field gel electrophoresis of DNA. 2. Effect of pulse time and electric field strength and implications for models of the separation process, 15:1386 (J;US)

ELECTROSTATIC WAVES
See PLASMA WAVES

ELECTROWEAK MODEL
See WEINBERG-SALAM GAUGE MODEL
EMERGENCY PLANS
Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)
EMERGENCY PROVISIONS
See EMERGENCY PLANS
EMISSION
Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986, 15:1263 (R;GB)
EMP
See ELECTROMAGNETIC PULSES
EMPLOYEES
See PERSONNEL
ENDANGERED SPECIES
Biodiversity, 15:1392 (R;US)
Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report, 15:1390 (R;US)
ENDONUCLEASES
Model for how type I restriction enzymes select cleavage sites in DNA, 15:1381 (J;US)
ENERGY ANALYSIS
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 10, Performance measurement and analysis, 15:683 (R;US)
Evaluation of microcomputer programs for commercial building energy analysis: Final report, 15:591 (R;US)
ENERGY CONSERVATION
How far can the world get on energy efficiency alone?, 15:588 (R;US)
ENERGY CONSUMPTION
Monthly energy review, July 1989, 15:648 (R;US)
ENERGY EFFICIENCY
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 8, Planning and forecasting, 15:681 (R;US)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 9, Program evaluation, 15:682 (R;US)
Application of combustion air pre-heating to 50t/h water tube boilers. A demonstration at British Sugar plc. [York], 15:711 (R;GB)
Energy efficiency in the housing stock, 15:675 (R;GB)
Environmental boundaries to energy development, 15:616 (R;US)
Extraction of landfill gas. A demonstration at Bidston Moss [Birkenhead], 15:225 (R;GB)
Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)
Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds, 15:707 (R;GB)
How far can the world get on energy efficiency alone?, 15:588 (R;US)
Waste heat recovery on a catalytic reformer through the application of a process integration study. A demonstration at ICI plc. [Middlesbrough], 15:706 (R;GB)
ENERGY EXCHANGE
See ENERGY TRANSFER
ENERGY FACILITIES
Directory of biomass energy facilities in the northeast, 15:244 (R;US)
ENERGY MANAGEMENT
How far can the world get on energy efficiency alone?, 15:588 (R;US)
ENERGY MANAGEMENT SYSTEMS
Energy management on a medium-sized pharmaceutical production plant. Demonstration at Reckitt and Colman Ltd. [Kingston-upon-Hull], 15:686 (R;GB)
ENERGY MODELS
PC-AEO forecasting model for the Annual Energy Outlook 1989: Model documentation, 15:589 (R;US)
ENERGY SECURITY ACT
Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987, 15:11 (R;US)
ENERGY SOURCE DEVELOPMENT
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Oregon) Volume 1 of 4. Final report, 15:608 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon). Volume 4 of 4. Final report, 15:611 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington) Volume 4 of 4. Final report, 15:607 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report, 15:614 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington). Volume 2 of 4. Final report, 15:605 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 3 of 4. Final report, 15:610 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report, 15:613 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington). Volume 1 of 4. Final report, 15:604 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington) Volume 3 of 4. Final report, 15:606 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report, 15:612 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report, 15:615 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 2 of 4. Final report, 15:609 (R;US)
ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS
WOOD FUELS
Monthly energy review, July 1989, 15:648 (R;US)
ENERGY SUPPLIES
EIA Domestic Oil Production Estimates. Hearing before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session, April 29, 1987, 15:59 (B;US)
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)
ENERGY TRANSFER
See also HEAT TRANSFER
Trends in environmentally induced spacecraft anomalies, 15:1687 (RA;BR)
ENGINEERED SAFETY SYSTEMS
See also CONTAINMENT SYSTEMS
Corrections for graphite-induced problems in N reactor, 15:528 (J;US)
Passive containment cooling for an advanced PWR, 15:373 (J;US)
ENGINEERING
See also CHEMICAL ENGINEERING
CIVIL ENGINEERING
NUCLEAR ENGINEERING
Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988, 15:981 (R;US)
ENGINEERING DRAWINGS
Grout treatment facility dangerous waste permit application: Drawings: Addendum 1, 15:145 (R;US)
ORNL Drawing Q-6240-2 (Rev.3) and Parts List Q-6240-5 (Engineering Materials), 15:1072 (E;US)
ENGLAND
See UNITED KINGDOM

ENHANCED RADIATION WEAPONS
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
ENHANCED RECOVERY
Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)
ENRICO FERMI-1 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
ENRICO FERMI-2 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
ENTROPY
Algorithmic randomness, physical entropy, measurements, and the second law, 15:1880 (R;US)
ENVIRONMENT
Environmental and climate research programme 1988/89, 15:1236 (R;DE;In German)
ENVIRONMENTAL EXPOSURE
Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)
Workshop report on EPA (Environmental Protection Agency) guidelines for carcinogen risk assessment. Held in Virginia Beach, Virginia on January 11-13, 1989, 15:1462 (R;US)
ENVIRONMENTAL IMPACTS
Transport properties of radionuclides and hazardous chemical species in soils at the Idaho Chemical Processing Plant, 15:175 (R;US)
ENVIRONMENTAL PARKS
See NATURE RESERVES
ENVIRONMENTAL POLICY
A compendium of options for government policy to encourage private sector responses to potential climate change: Volume 2, Policy options by sector and considerations for assembling a policy package, 15:1329 (R;US)
Environmental Regulatory Update Table, September 1989, 15:1300 (R;US)
Environmental boundaries to energy development, 15:616 (R;US)
Environmental regulatory update table, 15:1299 (R;US)
[Managing the global environment]: Foreign trip report, September 9, 1989–September 23, 1989, 15:1261 (R;US)
ENVIRONMENTAL PROTECTION AGENCY
See US EPA
EOCENE EPOCH
How many upper Eocene microspherule layers: More than we thought, 15:1487 (RA;US)
Inducement of heterochronic variation in a species of planktic foraminifera by a Late Eocene impact event, 15:1499 (RA;US)
Late Eocene impact events recorded in deep-sea sediments, 15:1483 (RA;US)
EPA
See US EPA
EPIDEMIOLOGY
Health, Safety, and Environment Division annual report, 1988, 15:1284 (R;US)
EQUATORIAL ELECTROJETS
See ELECTROJETS
EQUIPMENT
See also DISTILLATION EQUIPMENT
DRILLING EQUIPMENT
ELECTRICAL EQUIPMENT
ELECTRONIC EQUIPMENT
HEAT RECOVERY EQUIPMENT
MATERIALS HANDLING EQUIPMENT
MILITARY EQUIPMENT
OPTICAL EQUIPMENT
THERMAL ENERGY STORAGE EQUIPMENT
WELL LOGGING EQUIPMENT
X-RAY EQUIPMENT
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)
Doubly-fluted tubes and enhanced tubes in confined crossflow. Annual report, August 1987-July 1988, 15:1057 (R;US)
EQUIPMENT PROTECTION DEVICES
See also CIRCUIT BREAKERS
Experimental study of direct lightning hits on power distribution lines, 15:315 (R;JP;In Japanese)
ERBIUM OXIDES
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Evaluation of erbia as a burnable absorber in a 24-month, low-leakage C-E core, 15:362 (J;US)
ESCA
See ELECTRON SPECTROSCOPY
ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
ETHANE
A simplified representation for the thermal conductivity of fluids in the critical region, 15:949 (J;US)
ETHANOL
Nucleoside adducts are formed by cooperative reaction of acetaldehyde and alcohols: Possible mechanism for the role of ethanol in carcinogenesis, 15:1464 (J;US)
Process for producing ethanol from plant biomass using the fungus paecilomyces sp, 15:229 (P;US)
Selective pervaporation of organics from water, 15:938 (R;DE)
ETHOCEL
See CELLULOSE
ETHYL ALCOHOL
See ETHANOL
ETHYLENE
Regulation of ethylene biosynthesis in plants; properties of ACC synthase, 15:1369 (RA;US)
ETHYLENE POLYMERS
See POLYETHYLENES
EUPHORBIA
See also CHINESE TALLOW TREE
Effect of applied environmental stress on growth, photosynthesis, carbon allocation, and hydrocarbon production in Euphorbia lathyris, 15:226 (RA;US)
EUROPIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
EUROPIUM ISOTOPES
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
EVAPORATORS
Evaporation characteristics of a reprocessing plant HLLW concentrator, 15:187 (J;US)
EXCHANGE (HEAT)
See HEAT TRANSFER
EXCHANGE (ION)
See ION EXCHANGE
EXCITATION
Semiclassical theory of polyatomic infrared Multiphoton Processes, phase 1. Appendices A through C. Technical report (Final), 15:1695 (R;US)
EXHAUST GASES
Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)
Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)
EXHAUST SYSTEMS
Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations from the NTIS data base). Report for September 1979-July 1989, 15:744 (R;US)
EXPERIMENTAL BREEDER REACTOR-2
See EBR-2 REACTOR
EXPERT SYSTEMS
An examination of expert systems activities within the nuclear industry, 15:469 (J;US)

Development and assessment of an AI expert system for the monitoring and diagnosis of nuclear power plants, 15:455 (J;US)
Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs, 15:737 (R;US)
The TEX-I real-time expert system, applied to situation assessment for the SNR-300 reactor, 15:396 (J;US)

EXPORTS
H.R. 5041: A bill to amend the Export Administration Act of 1979 to restrict the export of certain petroleum products from certain oil refineries. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988, 15:71 (B;US)

EXPOSURE (RADIATION DOSES)
See RADIATION DOSES

EXTRACTION (BEAM)
See BEAM EXTRACTION

EXTRACTION COLUMNS
Calculation of concentration profiles and their experimental verification with a pulsed sieve-plate column and the reactive material system of uranyl nitrate, nitric acid/tributyl phosphate, kerosine, 15:122 (R;DE;In German)

EXXON DONOR SOLVENT LIQUEFACTION
See EXXON LIQUEFACTION PROCESS

EXXON LIQUEFACTION PROCESS
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)

EYES
Ultraviolet-induced photochemical damage in the ocular tissues. Final report, 15:1418 (R;US)

F

F CODES
Computation of dynamics and erosion for small tube arrays in fluidized beds, 15:1088 (BA;US)
Spectral analysis of dynamics in fluidized bed tube banks, 15:1087 (BA;US)

F REGION
See also F1 LAYER
SPREAD F
Equatorial F region electrodynamics, 15:1657 (RA;BR)
F-region bubbles: effects of vertical plasma drifts, 15:1649 (RA;BR)
Ionospheric electron temperature rocket measurements with langmuir probe over Natal, Brazil, in 1985, 15:1897 (RA;BR)
Low-latitude F-region dynamical processes from atomic oxygen nightGlow emissions, 15:1648 (RA;BR)
Semiempirical model for calculating the critical frequency of F region on Concepcion, Chile, 15:1802 (RA;BR;In Spanish)
TEC studies in Argentina, 15:1652 (RA;BR)

F1 LAYER
Modern problems in physics of variations of the ionosphere at the altitudes 100-200 Km, 15:1628 (RA;BR)

FACILITIES (EDUCATIONAL)
See EDUCATIONAL FACILITIES

FACILITIES (ENERGY)
See ENERGY FACILITIES

FACILITIES (MAINTENANCE)
See MAINTENANCE FACILITIES

FACILITIES (MILITARY)
See MILITARY FACILITIES

FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES

FACILITIES (STORAGE)
See STORAGE FACILITIES

FALLOUT PARTICULATES
See PARTICLES

FAST BREEDER TYPE REACTORS
See FBR TYPE REACTORS

FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR

FAST REACTORS
See also FBR TYPE REACTORS
FFTF REACTOR
Components of neutronic state for calculating the phase library in the neutronic simulation of a low power experimental fast reactor, 15:476 (R;BR;In Portuguese)
Two-dimensional suboptimal calibration of the shadow factors in the experimental fast reactor-BR-82, 15:425 (R;BR;In Portuguese)

FAST-MIXED SPECTRUM REACTOR
See FBR TYPE REACTORS

FBR TYPE REACTORS
See also LMFBR TYPE REACTORS
A phenomenological model of the classical thermal creep curve, 15:394 (J;US)
Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C, 15:395 (J;US)

FEDERAL BUILDINGS
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
Ventilation and air-quality investigation of the US Geological Survey building, 15:692 (R;US)

FEDERAL DRIVING CYCLE
See FEDERAL TEST PROCEDURE

FEDERAL ENERGY REGULATORY COMMISSION
See US FERC

FEDERAL REPUBLIC OF GERMANY
Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988, 15:1542 (R;DE)
The American Nuclear Society's international student exchange program, 15:435 (J;US)
The University of Stuttgart IKE/University of Arizona student research program, 15:436 (J;US)

FEDERAL TEST PROCEDURE
Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations from the NTIS data base). Report for September 1979-July 1989, 15:744 (R;US)

FEDERAL WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT

FEEDWATER
Analysis of loss-of-feedwater transients in MB-2 using RELAP5/MOD2, 15:513 (J;US)
Analysis of postulated unscrammed loss of flow in SAFR using SSC, 15:516 (J;US)

FELDSPARS
Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean, 15:1490 (RA;US)

FERMENTATION ALCOHOL
See ETHANOL

FERMI-THOMAS MODEL
See THOMAS-FERMI MODEL

FERMILAB ACCELERATOR
A real time integrated environment for Motorola 680chichi-based VME and FASTBUS modules, 15:1140 (J;US)
Data acquisition for FNAL E665, 15:1134 (J;US)
Exabyte helical scan devices at Fermilab, 15:1136 (J;US)
FEREAD: Front end readout software for the Fermilab PAN-DA data acquisition system, 15:1138 (J;US)
Software for FASTBUS and Motorola 68K based readout controllers for data acquisition, 15:1133 (J;US)
The PAN-DA data acquisition system, 15:1135 (J;US)
Uniform communications software using TCP/IP, 15:1139 (J;US)

FERMILAB TEVATRON
Three-dimensional survey techniques for large detector systems, 15:1204 (J;NL)

FERMIONS
See also BARYONS
LEPTONS
QUARKS

Bounds on the mass of W_R and the W_L-W_R mixing angle ζ in general $SU(2)_L \times SU(2)_R \times U(1)$ models, 15:1754 (J;US)
Calculation of ground states for many-fermion systems, 15:1882 (J;US)

FERRIC COMPOUNDS
See IRON COMPOUNDS

FERRITES
A simple domain model of flux reversal in ferrites, 15:1129 (R;US)

FERROMAGNETIC MATERIALS
Bosonic mean-field theory of quantum Heisenberg spin systems: Bose condensation and magnetic order, 15:1866 (J;US)
Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures, 15:1017 (P;US)

FERROUS COMPOUNDS
See IRON COMPOUNDS

FERTILIZER INDUSTRY
Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)

FERTILIZERS
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)

FFTF REACTOR
Operating team training: Technical training's role, 15:478 (R;US)

FIBER OPTICS
Optical acoustic sensor using optical fiber, 15:1213 (R;JP;In Japanese)

FIBERS
See also OPTICAL FIBERS
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)

FIBROBLASTS
Publications resulting from research supported in whole or in part by this grant: Progress report, September 1987–August 1988, 15:1441 (R;US)

FIELD EFFECT TRANSISTORS
Characterization and development report for the SA3259: An operational amplifier, 15:1074 (R;US)

FIELD EMISSION MICROSCOPY
See ION MICROSCOPY

FIELD ION MICROSCOPY
See ION MICROSCOPY

FIELDS (ELECTRIC)
See ELECTRIC FIELDS

FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS

FIELDS (MAGNETIC)
See MAGNETIC FIELDS

FINANCIAL MANAGMENT
See PROGRAM MANAGEMENT

FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
PATTERN RECOGNITION

FIRE DETECTORS
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)

FIREDAMP
See METHANE

FIREHOSE INSTABILITY
See HOSE INSTABILITY

FIREWOOD
See WOOD FUELS

FISCHER-TROPSCH SYNTHESIS
Method of inducing surface ensembles on a metal catalyst, 15:15 (P;US)

FISSILE MATERIALS
Applications of probabilistic risk assessment to criticality safety at the Savannah River Site, 15:507 (R;US)
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
Doses to railroad workers from shipments of radioactive materials, 15:205 (J;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)
Use of borosilicate glass in fissile operations at Savannah River (U), 15:897 (R;US)

FISSION CHAMBERS
Consideration of the $^{12}C(n,n')3\alpha$-reaction as a background source within a methan filled fission chamber for neutrons of $\sim$ 19 MeV, 15:1192 (RA;DD)
Correlation between fission fragment absorption losses and the plateau height in fission chamber spectra, 15:1832 (RA;DD)

FISSION FOIL DETECTORS
Determination of the inhomogeneity of U-238 fission-foils by Rutherford-backscattering (RBS) measurements, 15:969 (RA;DD)

FISSION FRAGMENTS
Correlation between fission fragment absorption losses and the plateau height in fission chamber spectra, 15:1832 (RA;DD)
Experimental arrangement for the measurement of correlations between fission products and neutrons, 15:1197 (RA;DD)
Gradually evaporated foils for aberration correction of fission fragment time-of-flight in a direction-sensitive arrangement, 15:1196 (RA;DD)
ISOPLOT 2 - a program for graphic representation of functions Z = F(X,Y), 15:1812 (RA;DD)

FISSION NEUTRONS
See also DELAYED NEUTRONS
Cone broadening in time-correlated associated-particle method fission cross-section measurements, 15:1782 (RA;DD)
Experimental arrangement for the measurement of correlations between fission products and neutrons, 15:1197 (RA;DD)

FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT

FISSURED FORMATIONS
See FRACTURED RESERVOIRS

FLAMES
Laser-induced fluorescence determination of temperatures in low pressure flames, 15:978 (J;US)

FLAVOR MODEL
Hierarchical chiral symmetry breaking and quark mass matrices revisited, 15:1743 (J;DE)

FLOW (FLUID)
See FLUID FLOW

FLOW MODELS
Validation of Computational Fluid Dynamics. Volume 2: Poster papers, 15:1049 (R;FR)

FLOW RATE
Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)

FLUE GAS
Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement, 15:26 (R;US)

FLUID FLOW
See also GAS FLOW
LAMINAR FLOW
TURBULENT FLOW
TWO-PHASE FLOW
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
Domain decomposition algorithms and computation fluid dynamics, 15:1055 (R;US)
Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)
Validation of Computational Fluid Dynamics. Volume 1. Symposium papers and round table discussion, 15:1048 (R;FR;In several languages)

Validation of Computational Fluid Dynamics. Volume 2: Poster papers, 15:1049 (R;FR)

FLUID MECHANICS
See also HYDRAULICS
HYDRODYNAMICS
Digital image processing in flow visualization, 15:1702 (BA;US)
Proceedings of the seventh symposium on energy engineering sciences: Nonlinear mechanics and mechanical systems, 15:1051 (R;US)

FLUIDIZED BED
See FLUIDIZED BEDS

FLUIDIZED BED REACTORS
A combustion/deposition entrained reactor for high temperature/pressure studies of coal and coal minerals, 15:35 (B;US)
Fluidized-bed bioreactor process for the microbial solubilization of coal, 15:14 (P;US)

FLUIDIZED BEDS
Fossil energy research program: Project status quarterly report, April 1–June 30, 1989, 15:30 (R;US)

FLUIDIZED-BED COMBUSTORS
Computation of dynamics and erosion for small tube arrays in fluidized beds, 15:1088 (BA;US)
On the erosion of heat exchanger tube banks in fluidized bed combustors, 15:1086 (BA;US)
Spectral analysis of dynamics in fluidized bed tube banks, 15:1087 (BA;US)

FLUIDS
See also CRYOGENIC FLUIDS
GASES
GEOTHERMAL FLUIDS
LIQUIDS
Calculation of natural convection boundary layer profiles using the local similarity approach including turbulence and mixed convection, 15:46 (R;US)

FLUORESCENCE SPECTROSCOPY
Development of laser excited atomic fluorescence and ionization spectrometric methods: Progress report, January 1, 1989–October 1, 1989, 15:918 (R;US)

FLUORIMETRY
See FLUORESCENCE SPECTROSCOPY

FLUORINATED ALIPHATIC HYDROCARBONS
Vapor pressures and gas-phase PVT data for 1,1,1,2-tetrafluoroethane, 15:950 (J;US)

FLUORINE 19
Nucleon and nuclear anapole moments, 15:1815 (J;US)

FLUORITE
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)

FLUX (COSMIC RAY)
See COSMIC RAY FLUX

FLUX (NEUTRON)
See NEUTRON FLUX

FLY ASH
Accumulation of alveolar macrophages in golden hamster lung after long-term exposure to coal fly-ash particles, 15:37 (R;JP;In Japanese)
Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)
Municipal waste disposal crisis. Hearings before the Subcommittee on Transportation, Tourism, and Hazardous Materials of the Committee on Energy and Commerce, House of Representatives, One hundredth Congress, First Session, March 19, May 6, and June 5, 1989, 15:740 (B;US)

FOAMS
Flame retardant polymeric foams: Manufacturing, applications, and hazards. July 1984-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for July 1984-August 1989, 15:893 (R;US)
Viscous effects in foam rheology, 15:56 (B;US)

FOOD
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)
Separation, fractionation concentration and drying of food products: Addendum report, April 1, 1988–April 30, 1989, 15:701 (R;US)
Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988, 15:166 (R;US)

FOOD INDUSTRY
Heat recovery and energy saving using a Baker Perkins Simplex 2000 bread baking oven. A demonstration at Mothers Pride Bakery. [Nottingham], 15:704 (R;GB)

FOOD IRRADIATION
See FOOD PROCESSING

FOOD PROCESSING
Alaskan Commodities Irradiation Project: An options analysis study, 15:1415 (R;US)
Separation, fractionation concentration and drying of food products: Addendum report, April 1, 1988–April 30, 1989, 15:701 (R;US)
[Alaskan commodities irradiation project: An options analysis study]: Final technical report, 15:1414 (R;US)

FOODSTUFFS
See FOOD

FORESTS
Sampling and analysis protocols and project description for the Integrated Forest Study, 15:1262 (R;US)
[Global natural resource monitoring and assessment]: Foreign trip report, September 23–October 7, 1989, 15:1301 (R;US)

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PEAT
PETROLEUM
Centrifuges: fuel technology applications. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:12 (R;US)

FOSSIL-FUEL POWER PLANTS
Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement, 15:26 (R;US)
Clean-coal technologies - a Midwest project update, 15:642 (RA;US)
Economic potential for future water reactors, 15:350 (J;US)
Gas reburning-sorbent injection for controlling SO_{chi} and NO_{chi} utility boilers, 15:312 (B;US)
Lessons learned in a systemwide implementation of RCM, 15:306 (J;US)
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
Proceedings: Reducing power plant emissions by controlling coal quality, 15:310 (R;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
Targeted chlorination schedules: Final report, 15:302 (R;US)

FOSSILS
Extended Cretaceous-Tertiary (K/T) stable isotope record. Implications for paleoclimate and the nature of the K/T boundary event, 15:1478 (RA;US)

FOUNDATIONS
Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)

FOUNDRIES
Foundry ladle preheater of improved design. A demonstration at North British Steel Group Ltd. [Bathgate], 15:714 (R;GB)

FRACTURE MECHANICS
Nonlinear fracture mechanics. Volume 2. Elastic-plastic fracture, 15:802 (B;US)

FRACTURE PROPERTIES
Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989, 15:753 (R;US)

FRACTURE STRENGTH
See FRACTURE PROPERTIES
FRACTURE TOUGHNESS
See FRACTURE PROPERTIES
FRACTURED FORMATIONS
See FRACTURED RESERVOIRS
FRACTURED RESERVOIRS
Characterization and significance of natural fractures in Mesaverde Reservoirs at the Multiwell Experiment site, 15:87 (BA;US)
FRAGMENTS (FISSION)
See FISSION FRAGMENTS
FRAGMENTS (PARTICLES)
See PARTICLES
FRANCE
Collaboration in nuclear engineering education between France and the United States: Research opportunities for US students in France, 15:433 (J;US)
Collaboration in nuclear engineering education between France and the United States: Participation of French students at Texas A & M University, 15:434 (J;US)
Introduction of advanced pressurized water reactors in France, 15:368 (J;US)
The American Nuclear Society's international student exchange program, 15:435 (J;US)
FRANCO-GERMAN HIGH FLUX REACTOR
See GRENOBLE REACTOR
FREE ELECTRON LASERS
Analytical treatment of electron trajectory straightener issues in free-electron lasers, 15:1030 (R;US)
Compact short-wavelength free-electron laser, 15:1041 (J;US)
High-power free-electron lasers driven by r-f (radio-frequency) linear accelerators. Memorandum report (Interim), 15:1022 (R;US)
Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988, 15:1021 (R;US)
On the small-signal gain of free-electron lasers in the low-current region, 15:1029 (R;FR)
Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)
Self-focusing of laser beams in magnetized relativistic electron beams, 15:1909 (BA;US)
Spaced-based free electron laser, 15:1686 (RA;BR)
FREONS
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
S. 503: A bill Chlorofluorocarbons and Halon Reduction Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1293 (B;US)
FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
FRUIT (SEEDS)
See SEEDS
FTR REACTOR (RICHLAND)
See FFTF REACTOR
FUEL ADDITIVES
Fuel additives. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:79 (R;US)
FUEL ASSEMBLIES
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)
Evaluation of ANF fuel failures in oyster creek, 15:344 (J;US)
Tramp uranium, 15:542 (J;US)
FUEL CANS
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)
FUEL CELL CATALYSTS
See ELECTROCATALYSTS
FUEL CELLS
See also HYDROCARBON FUEL CELLS
HYDROGEN FUEL CELLS
REGENERATIVE FUEL CELLS
Canadian solid polymer fuel cell development, 15:667 (BA;US)
European fuel cell research and development projects, 15:671 (BA;US)
Fabrication of solid oxide fuel cell by electrochemical vapor deposition, 15:672 (P;US)
International Power Sources Symposium, 33rd, Cherry Hill, NJ, June 13-16, 1988, Proceedings, 15:564 (B;US)
Proton exchange membrane fuel cells, 15:669 (BA;US)
The application of Dow Chemical's perfluorinated membranes in proton-exchange membrane fuel cells, 15:660 (RA;US)
FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE
FUEL CYCLE CENTERS
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
FUEL ELEMENT FAILURE
Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample, 15:519 (J;US)
Comparison of the effect of insulating blockages on metal and oxide fuel elements, 15:517 (J;US)
FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
SPENT FUEL ELEMENTS
THERMIONIC FUEL ELEMENTS
A Japanese gadolinia fuel usage and demonstration program, 15:359 (J;US)
Improvements in fabrication of metallic fuels, 15:113 (R;US)
FUEL FABRICATION PLANTS
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Regulatory actions and initiatives based on results of NRC operational safety assessments of fuel cycle facilities, 15:210 (J;US)
Safety team assessments at NRC [Nuclear Regulatory Commission]-licensed fuel facilities, 15:209 (J;US)
FUEL INJECTION SYSTEMS
A laboratory test for fuel injector deposit studies, 15:743 (R;US)
The CIT [compact ignition tokamak] pellet injection system: Description and supporting research and development, 15:1919 (R;US)
FUEL LOADING
See REACTOR FUELING
FUEL MANAGEMENT
Combustion engineering nuclear plant performance trends, 15:379 (J;US)
FUEL OILS
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)
FUEL PENCILS
See FUEL PINS
FUEL PINS
A phenomenological model of the classical thermal creep curve, 15:394 (J;US)
FUEL REPROCESSING
See REPROCESSING
FUEL REPROCESSING PLANTS
See also IDAHO CHEMICAL PROCESSING PLANT
SELLAFIELD REPROCESSING PLANT
Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1, 15:117 (R;DE;In German)
Criticality experiments with mixed plutonium-uranium nitrate solution at plutonium fraction of 0.5, 0.4, and 0.2 in slab and cylindrical geometry, 15:1003 (J;US)

Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)

FUEL ROD CONSOLIDATION
See FUEL RODS

FUEL RODS
Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers, 15:343 (J;US)
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)
Evaluation of erbia as a burnable absorber in a 24-month, low-leakage C-E core, 15:362 (J;US)

FUEL SHEATHS
See FUEL CANS

FUEL SLUGS
See FUEL RODS

FUEL SLURRIES
Radiant heating of small multiphase fuel droplets, 15:36 (BA;US)
Western New York State coal-water fuel market and boiler-conversion study. Final report, 15:32 (R;US)

FUEL SUBSTITUTION
A comparative analysis of alternative fuel infrastructure requirements, 15:745 (R;US)

FUEL SUSPENSIONS
See FUEL SLURRIES

FUEL-AIR RATIO
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)

FUEL-COOLANT INTERACTIONS
Hydrogen generation during fuel/coolant interactions, 15:510 (J;US)

FUELS
See also AUTOMOTIVE FUELS
AVIATION FUELS
BOILER FUELS
FOSSIL FUELS
FUEL SLURRIES
JET ENGINE FUELS
LIQUID FUELS
NUCLEAR FUELS
SYNTHETIC FUELS
THERMONUCLEAR FUELS
WOOD FUELS
A combustion/deposition entrained reactor for high temperature/pressure studies of coal and coal minerals, 15:35 (B;US)
Centrifuges: fuel technology applications. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:12 (R;US)
Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)

FUELS (NUCLEAR)
See NUCLEAR FUELS

FUELWOOD
See WOOD FUELS

FUMES
See AEROSOLS

FUNCTIONAL MODELS
Using object-oriented development to support prototyping, 15:1998 (R;US)

FUNCTIONS
Numerical solution of some classical differential-difference equations, 15:2003 (J;US)

FURANS
Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)

FUSION (NUCLEAR)
See THERMONUCLEAR REACTIONS

FUSION (WELDING)
See WELDING

FUSION ENERGY
See THERMONUCLEAR REACTORS

FUSION FUELS
See THERMONUCLEAR FUELS

FUSION REACTORS
See THERMONUCLEAR REACTORS

FUSION YIELD
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)

G

GADOLINIUM
Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures, 15:1017 (P;US)

GADOLINIUM OXIDES
A Japanese gadolinia fuel usage and demonstration program, 15:359 (J;US)
Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers, 15:343 (J;US)
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Use of Axially zoned gadolinia in GE [General Electric Co.] BWR reload fuel, 15:342 (J;US)

GALACTIC EVOLUTION
Formation of shell galaxies. II. Nonspherical potentials, 15:1608 (J;US)
Ideal black hole gas, 15:1593 (R;US)
Neutron stars and white dwarfs in galactic halos, 15:1589 (R;US)

GALAXIES
See also MAGELLANIC CLOUDS
Distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter dominated universe, 15:1572 (R;US)
Formation of shell galaxies. II. Nonspherical potentials, 15:1608 (J;US)
Neutron stars and white dwarfs in galactic halos, 15:1589 (R;US)

GALAXY CLUSTERS
Ideal black hole gas, 15:1593 (R;US)

GALLIUM
Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)

GALLIUM ALLOYS
Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)

GALLIUM ARSENIDE SOLAR CELLS
28% efficient GaAs concentrator solar cells, 15:261 (BA;US)
A 31%-efficient GaAs/silicon mechanically stacked, multijunction concentrator solar cell, 15:289 (BA;US)
High altitude current-voltage measurement of GaAs/Ge solar cells, 15:268 (BA;US)
Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells, 15:265 (BA;US)
Material quality and design optimization for high efficiency GaAs solar cells, 15:266 (BA;US)
Recent advances in high-efficiency InGaAs concentrator cells, 15:288 (BA;US)
The GaAs solar cells with V-grooved emitters, 15:251 (R;US)

GALLIUM ARSENIDES
Carrier-lifetime control of photochemical dry etching using elevated impurity concentrations, 15:909 (J;US)
Defects in laser annealed ion implanted GaAs layers, 15:1855 (RA;DD)
Development of a unique laboratory standard: Indium gallium arsenide detector for the 500-1700 nm spectral region. Final report, 15:884 (R;US)
Gallium arsenide recycle chemistry and metallurgy, 15:718 (R;US)
III-V compound process development using photoluminescence lifetime, 15:905 (BA;US)

Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs, 15:1040 (J;US)
Minority carrier lifetime of GaAs on silicon, 15:906 (BA;US)
Monte Carlo study of photogenerated carrier transport in GaAs surface space-charge fields, 15:911 (J;US)
RBS investigations of defects in weakly damaged GaAs, 15:1854 (RA;DD)
Raman and RBS studies of ion implanted semiconductors, 15:869 (R;US)
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
Ultralong minority-carrier lifetime epitaxial GaAs by photon recycling, 15:907 (J;US)

GALLIUM PHOSPHIDE SOLAR CELLS
Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells, 15:265 (BA;US)

GAMMA RADIATION
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Evaluation of $\gamma\gamma$-coincidence matrices, 15:1200 (RA;DD)
Optimization of transmission method for using in safeguards, 15:929 (R;BR;In Portuguese)
The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater, 15:138 (R;US)

GAMMA REACTIONS
See PHOTONUCLEAR REACTIONS

GAMMA SPECTRA
Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV, 15:1806 (R;US)

GAMMA SPECTROMETERS
See also MOESSBAUER SPECTROMETERS
Investigations with the aim of installation a low-level γ-spectrometer, 15:1187 (RA;DD)

GARDENHOSE INSTABILITY
See HOSE INSTABILITY

GAS ANALYSIS
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)

GAS APPLIANCES
Assessment of technology for self-powered gas appliances: A GATC (Gas Appliance Technology Center) task report, July 1988-January 1989, 15:103 (R;US)

GAS CHROMATOGRAPHY
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)

GAS COOLANTS
See GASES

GAS DYNAMIC LASERS
Laser-mixing processes. Final report, 1 July 1977-31 October 1978, 15:1025 (R;US)

GAS ENGINES
See INTERNAL COMBUSTION ENGINES

GAS FLOW
Accuracy and efficiency of a time marching approach for combustor modeling, 15:971 (RA;FR)
Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)
Flux Jacobian matrices and generaled Roe average for an equilibrium real gas, 15:1717 (R;US)

GAS FURNACES
Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds, 15:707 (R;GB)

GAS HEAT PUMPS
Evaluation of auxiliary-power subsystems for gas-engine heat pumps. Topical report, April 1987-October 1988, 15:102 (R;US)

GAS SCINTILLATION DETECTORS
Gas detectors for heavy ions, 15:1164 (R;FR;In French)

GAS TURBINE ENGINES
Application of Advanced Material for Turbomachinery and Rocket Propulsion, 15:756 (R;US)
Damage tolerance concepts for advanced materials and engines, 15:1082 (RA;US)

GAS TURBINES
See also COAL-FIRED GAS TURBINES
Rotor instability due to a gear coupling connected to a bearingless sun wheel of a planetary gear, 15:304 (RA;US)
Turbine rotor/stator flowfield analysis, 15:1083 (R;US)

GAS WELLS
See NATURAL GAS WELLS

GASES
See also AIR
DISSOLVED GASES
EXHAUST GASES
SYNTHESIS GAS
A global existence theorem for the nonlinear BGK equation, 15:1747 (J;US)
Corrosive resistant heat exchanger, 15:729 (P;US)
Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT, 15:1654 (RA;BR)

GASOLINE
Gasoline marketing: States' programs for pump labeling of gasoline ingredients, 15:66 (R;US)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GE SEMICONDUCTOR DETECTORS
See also LI-DRIFTED GE DETECTORS
[Data acquisition and analysis of data from highly segmented Ge gamma-ray detectors]: Foreign trip report, September 3, 1989–September 30, 1989, 15:1175 (R;US)

GE STANDARD REACTOR
Use of Axially zoned gadolinia in GE [General Electric Co.] BWR reload fuel, 15:342 (J;US)

GE(LI) DETECTORS
See LI-DRIFTED GE DETECTORS

GEARS
Rotor instability due to a gear coupling connected to a bearingless sun wheel of a planetary gear, 15:304 (RA;US)

GELATIN
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

GELS
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)

GENERAL ELECTRIC STANDARD REACTOR
See GE STANDARD REACTOR

GENERATORS (ELECTRIC)
See ELECTRIC GENERATORS

GENERATORS (STEAM)
See STEAM GENERATORS

GEOISOTHERM
See ISOTHERMS

GEOLOGIC AGES
Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause, 15:1489 (RA;US)

GEOLOGIC FORMATIONS
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)

GEOLOGIC FRACTURES
UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)

GEOLOGIC HISTORY
End-triassic mass extinction event, 15:1485 (RA;US)
How many upper Eocene microspherule layers: More than we thought, 15:1487 (RA;US)
Late Eocene impact events recorded in deep-sea sediments, 15:1483 (RA;US)

GEOLOGIC MODELS
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)

GEOLOGIC SURVEYS
Current research, 15:1467 (R;CA)
GEOLOGICAL SURVEYS
See GEOLOGIC SURVEYS
GEOMAGNETIC FIELD
Correlative analyses for geomagnetic indices, cosmic-ray intensities and sunspot numbers recorded since 1937, 15:1556 (RA;BR)
Field longitudinal assymmetry model for geomagnetic storms, 15:1643 (RA;BR;In Portuguese)
Geomagnetic research in Brazil, 15:1638 (RA;BR)
Signature of the equatorial ring current in the ground level geomagnetic field within the southern polar cap, 15:1645 (RA;BR)
Solar modulation on annual and semi-annual geomagnetic variations, 15:1641 (RA;BR;In Portuguese)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
GEOMAGNETIC STORMS
See MAGNETIC STORMS
GEOTHERMAL ENERGY
An economic prefeasibility study of geothermal energy development at Platanares, Honduras, 15:293 (R;US)
GEOTHERMAL EXPLORATION
Exploration and development of geothermal resources, 15:292 (R;JP)
Review of research and evaluation methods for environmental survey in geothermal development, 15:295 (R;JP;In Japanese)
GEOTHERMAL FLUIDS
Results of investigation at the Miravalles geothermal field, Costa Rica: Part 2, Downhole fluid sampling, 15:294 (R;US)
GEOTHERMAL POWER PLANTS
Geothermal heat cycle research supercritical cycle with counterflow condenser in different orientations, 15:296 (R;US)
Review of research and evaluation methods for environmental survey in geothermal development, 15:295 (R;JP;In Japanese)
GEOTHERMAL RESOURCES
Exploration and development of geothermal resources, 15:292 (R;JP)
GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY
GERMANIUM
The interaction of oxygen molecules with amorphous Ge, Ge:H, and some Ge:C:H alloys, 15:951 (J;US)
GERMANIUM ALLOYS
Dangling-bond states in a-Si,Ge:H,F measured by temperature-dependent μtau, 15:902 (BA;US)
GERMANIUM CARBIDES
The interaction of oxygen molecules with amorphous Ge, Ge:H, and some Ge:C:H alloys, 15:951 (J;US)
GERMANIUM DETECTORS
See GE SEMICONDUCTOR DETECTORS
GERMANIUM IONS
Wavelengths and energy levels for Ge xxiv, Ge xxv, and Ge xxvi observed in plasmas produced by line-focus laser irradiation, 15:1044 (J;US)
GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY
GERMS (MICROORGANISMS)
See MICROORGANISMS
GEYSERS GEOTHERMAL FIELD
Categorization of nocturnal drainage flows within the Brush Creek Valley and the variability of sigma theta in complex terrain, 15:1244 (J;US)
Influence of external meteorology on nocturnal valley drainage winds, 15:1287 (J;US)
GINNA-1 REACTOR
Experience-based classical RCM at Ginna, 15:367 (J;US)
GLACIERS
Volcanic ash layers in blue ice fields (Beardmore Glacier Area, Antarctica): Iridium enrichments, 15:1493 (RA;US)
GLASS
See also BOROSILICATE GLASS
PHOSPHATE GLASS
Analytical electron microscopy of leached nuclear waste glasses, 15:139 (R;US)
Correlation between composition effects on glass durability and the structural role of the constituent oxides, 15:196 (J;US)
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)
Glass electrolytes and some of their applications, 15:550 (RA;US)
Lead iron phosphate glass as a containment medium for disposal of high-level nuclear waste, 15:197 (P;US)
Nonlinear elasticity of amorphous solids, 15:908 (J;US)
On the atomic structure of the Nb/Al_2O_3 interface and the growth of Al_2O_3 particles, 15:804 (J;US)
Parametric effects of glass reaction under unsaturated conditions, 15:872 (R;US)
Reactions at the interface between multi-component glasses and metallic lithium films, 15:805 (J;US)
Structure and dynamics of disordered systems, 15:1829 (R;US)
GLASS MELTERS
See CERAMIC MELTERS
GLIOMAS
Sequential rat blood boron concentration measurements method using CR-39 SSNTDs, 15:1406 (J;US)
GLOBULINS-ALPHA
Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)
GLOW DISCHARGES
Langmuir probe characteristics in RF glow discharges, 15:1217 (J;US)
GLUCOSE
Enzyme-based fiber optic sensors, 15:1376 (BA;US)
GOBAR GAS
See METHANE
GOLD
Geometries and energy separations of 14 electronic states of Au_4, 15:1715 (J;US)
GOLD 197 TARGET
Equilibrium and non-equilibrium emission of complex fragments, 15:1788 (R;US)
Oregon State University nuclear chemistry progress report, August 1, 1988–August 1, 1989, 15:1794 (R;US)
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
GOLD BASE ALLOYS
Basic characteristics of an Au-Si-liquid metal ion source, 15:1699 (RA;DD)
Mass spectrometry of liquid metal ion sources, 15:1700 (RA;DD)
GOLDSTONE BOSONS
Electromagnetic polarizabilities of pseudoscalar Goldstone bosons, 15:1756 (J;US)
GOVERNMENT POLICIES
See also ENVIRONMENTAL POLICY
A compendium of options for government policy to encourage private sector responses to potential climate changes: Volume 1, Methodological justification and generic policy instruments, 15:1328 (R;US)
GRABS
Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989, 15:684 (R;US)
GRADED BAND GAP SOLAR CELLS
See CASCADE SOLAR CELLS
GRAIN ALCOHOL
See ETHANOL
GRAINS (CEREAL)
See SEEDS
GRAND GULF-1 REACTOR
MELCOR analyses of drywell flammability, 15:340 (R;US)
Rotating machinery surveillance system reduces plant downtime and radiation exposure, 15:346 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)

GRAND GULF-2 REACTOR
MELCOR analyses of drywell flammability, 15:340 (R;US)
Rotating machinery surveillance system reduces plant downtime and radiation exposure, 15:346 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)

GRANULOCYTES
See LEUKOCYTES

GRAPHITE
Layer-by-layer growth of solid argon films on graphite as studied by neutron diffraction, 15:913 (J;US)
Melting in multilayer adsorbed films, 15:914 (J;US)
Safety implications of a graphite oxidation accident in the compact ignition tokamak device, 15:1933 (R;US)
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)
In situ spectroscopic measurements of erosion behavior of Tokamak Fusion Test Reactor-redeposited carbon materials under high-flux plasma bombardment in PISCES-A (Plasma Interactive Surface Component Experimental Station-A), 15:910 (J;US)

GRAPHITE MODERATOR
See GRAPHITE

GRATINGS
Compact short-wavelength free-electron laser, 15:1041 (J;US)

GRAVITATIONAL INTERACTIONS
The topology of moduli space and quantum field theory, 15:1769 (J;NL)

GRAVITATIONAL WAVES
Gravitational radiation from extreme Kerr black hole, 15:1594 (R;US)

GRAVITY WAVES
Nonlinear waves. Technical report, 15:1877 (R;US)
Upper atmospheric research in Brazil, 15:1621 (RA;BR)

GREAT BRITAIN
See UNITED KINGDOM

GREAT LAKES
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)
Review and evaluation of contingency plans for oil and hazardous substances in the upper Great Lakes region. Final report, 15:1326 (R;US)

GREENHOUSE EFFECT
A compendium of options for government policy to encourage private sector responses to potential climate changes: Volume 1, Methodological justification and generic policy instruments, 15:1328 (R;US)
A compendium of options for government policy to encourage private sector responses to potential climate change: Volume 2, Policy options by sector and considerations for assembling a policy package, 15:1329 (R;US)
Carbon dioxide and climate. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1277 (R;US)
Carbon dioxide and climate. January 1970-July 1989 (Citations from Pollution Abstracts). Report for January 1970-July 1989, 15:1278 (R;US)
Quantifying the link between change in radiative balance and atmospheric temperature, 15:1280 (R;US)

GRENOBLE REACTOR
Experimental evaluation of the liquid deuterium fill fraction of the horizontal cold source moderating cell, 15:387 (TG;US)
Tests on wall temperatures of the moderator cell of the D_2 cold source in equilibrium and transient regimes, 15:388 (TG;US)
Thermodynamic and fluid dynamic experiments for the horizontal cold source of the Grenoble high flux reactor, 15:386 (TG;US)

GRIDS (COORDINATES)
See COORDINATES

GROUND MOTION
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)

GROUND WATER
Age Estimation
Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)

Contamination
A model for the future: Innovative combination of technologies for soil and groudwater VOC [volatile organic compound] remediation, 15:1327 (R;US)
Groundwater resources on Long Island. Joint hearing before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science, Space, and Technology, US House of Representatives and the Subcommittee on Water Resources, Transportation, and Infrastructure of the Committee on Environment and Public Works, US Senate,, 15:1361 (B;US)
Radioactive contamination and radionuclide migration in ground water. January 1970-May 1989 (Citations from the NTIS data base). Report for January 1970-May 1989, 15:1348 (R;US)

Data Base Management
EPA (Environmental Protection Agency) workshop to recommend a minimum set of data elements for ground water: workshop findings report, 15:1352 (R;US)

Environmental Transport
Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report, 15:1331 (R;US)

Flow Models
Intraval-project test case 5: tracer tests at Finnsjoen. Predictive modelling of the radially converging experiment, 15:179 (R;FI)

Fluid Flow
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)

Microorganisms
Microbiology of ground water. January 1977-August 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-August 1989, 15:1339 (R;US)

Monitoring
Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)
Contaminant transport in the Snake River Plain Aquifer: Phase 1, Part 1: Simple analytical model of individual plumes, 15:1298 (R;US)
Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill, 15:1303 (R;US)
Identification of contaminants of concern in Hanford ground waters, 15:1341 (R;US)
Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)
Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory, 15:1318 (R;US)

Radionuclide Migration
Filtration of polydispersed colloids, 15:180 (B;US)
Radioactive contamination and radionuclide migration in ground water. January 1970-May 1989 (Citations from the NTIS data base). Report for January 1970-May 1989, 15:1348 (R;US)

Radium
Evaluating various adsorbents and membranes for removing radium from ground water, 15:1346 (R;US)

Sampling
Effective sample labeling, 15:167 (R;US)

Water Pollution
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)

Water Pollution Control
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)

Water Quality
Contribution of subsoil and aquifer microorganisms to groundwater quality. Technical report, 1 July 1988-30 June 1989. (Final), 15:1334 (R;US)
Water Reclamation
Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation, 15:1332 (R;US)
Water Resources
Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)
GROUND-WATER RESERVES
See AQUIFERS
GROUNDWATER RECHARGE
See RECHARGE
GROWTH (CRYSTAL)
See CRYSTAL GROWTH
GROWTH (ECONOMIC)
See ECONOMIC GROWTH
GULF OF MEXICO
Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report, 15:1324 (R;US)
GYROTRONS
See MICROWAVE AMPLIFIERS

H

H-COAL PROCESS
Combustion of H-coal and EDS (Exxon Donor Solvent) coal liquids in a tangentially fired boiler. Final report, 15:31 (R;US)
HADRONS
See also BARYONS
Constituent approach to high energy elastic scattering of hadrons, 15:1724 (R;FR)
Measurement of α_s from hadron jets in e^+e^- annihilation at $\sqrt{s}$ of 29 GeV, 15:1727 (J;US)
The shell model approach: Key to hadron structure?, 15:1730 (R;US)
HAFNIUM ALLOYS
Charge transfer in intermetallics: $HfPt_3$, 15:813 (J;US)
Perturbed angular correlation study of impurity interactions in a cubic host metal: Hf in Nb, 15:807 (J;US)
Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009, 15:783 (R;US)
HAFNIUM ISOTOPES
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
HALLEY COMET
Comet Halley: The view from Pioneer Venus, 15:1577 (R;US)
Complete positive ion, electron, and ram negative ion measurements near Comet Halley (COPERNIC) plasma experiment for the European Giotto Mission. Final report, 15 April 1982-31 March 1988, 15:1595 (R;US)
HALOGENS
See also IODINE
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
S. 503: A bill Chlorofluorocarbons and Halon Reduction Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1293 (B;US)
HANDLING (DATA)
See DATA PROCESSING
HANDLING (WASTES)
See WASTE MANAGEMENT
HANFORD RESERVATION
300 Area process trench sediment analysis report, 15:1304 (R;US)
Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill, 15:1303 (R;US)
Grout treatment facility dangerous waste permit application: Drawings: Addendum 1, 15:145 (R;US)
Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989, 15:147 (R;US)
The April 1962 criticality event in the Recuplex facility, 15:174 (R;US)
Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988, 15:166 (R;US)
HARMONICS
Tracking harmonic notch filter, 15:333 (P;US)
HAZARDOUS MATERIALS
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)
Amines
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
Asbestos
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
Azo Dyes
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Chlorinated Aromatic Hydrocarbons
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)
Dioxin
Technologies for reducing dioxin in the manufacture of bleached wood pulp. Background paper, 15:738 (R;US)
Dusts
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
Ecological Concentration
Identification of contaminants of concern in Hanford ground waters, 15:1341 (R;US)
Environmental Effects
Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989, 15:147 (R;US)
Ground Disposal
Siting industrial waste land disposal facilities in Thailand: A risk based approach, 15:1317 (R;US)
Inventories
Agency for toxic substances and disease registry: Annual report for FY 1987, October 1, 1986–September 30, 1987, 15:1442 (R;US)
Metals
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Occupational Exposure
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)
Occupational Safety
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)

Organic Chlorine Compounds
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Pollution Abatement
S. 585: A bill Pollution Prevention Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 14, 1989, 15:1291 (B;US)
Quantitative Chemical Analysis
Effective sample labeling, 15:167 (R;US)
Quartz
Respirable quartz exposure at silica flour producers, 1975-1986, 15:1269 (R;US)
Solvents
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Superfund
Procedures for completion and deletion of National Priorities List sites, 15:617 (R;US)
Transport
H.R. 2266: Pipeline Safety Reauthorization Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, April 21, 1988, 15:98 (B;US)
Underground Storage
Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)
Waste Disposal
Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
Hazardous-waste-reduction guidelines for environmental-health programs, 15:724 (R;US)
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)
Waste Management
Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments, 15:721 (R;US)
Hazardous waste research and development in the Pacific Basin, 15:1297 (R;US)
Hazardous-waste technical-assistance survey, Carswell AFB, Texas. Final report, 16-27 May 1988, 15:730 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report, 15:733 (R;US)
Waste Storage
Hazardous Materiel Data File (HMDF), quarterly update. Data file, 15:619 (R;US)
Waste Transportation
Hazardous Materiel Data File (HMDF), quarterly update. Data file, 15:619 (R;US)
HAZARDOUS MATERIALS SPILLS
Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)
Railroad accident report: Head-on collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with release of hazardous materials near Altoona, Iowa, on July 30, 1988. Irregular report, 15:697 (R;US)
Review and evaluation of contingency plans for oil and hazardous substances in the upper Great Lakes region. Final report, 15:1326 (R;US)
HCDA
See REACTOR CORE DISRUPTION
HCLWR TYPE REACTORS
Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR, 15:492 (R;DE)
HD 8077
See NICKEL BASE ALLOYS
HEALTH HAZARDS
Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final, 15:732 (R;US)
HEALTH PHYSICS
See RADIATION PROTECTION
HEAT EXCHANGERS
See also RADIATORS
Corrosive resistant heat exchanger, 15:729 (P;US)
Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989, 15:984 (R;US)
Electroplating of copper. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:795 (R;US)
Fossil energy research program: Project status quarterly report, April 1–June 30, 1989, 15:30 (R;US)
On the erosion of heat exchanger tube banks in fluidized bed combustors, 15:1086 (BA;US)
Permeation of tritium through HYLIFE-II heat exchanger tubes, 15:1929 (R;US)
Two-dimensional numerical simulation of a Stirling engine heat exchanger, 15:1054 (R;US)
HEAT PIPES
High capacity demonstration of honeycomb panel heat pipes. Final technical report, 15:1052 (R;US)
HEAT RECOVERY
Copper vapour heat recovery using a spiral heat exchanger. A demonstration at Alloa Brewery Co., 15:708 (R;GB)
HEAT RECOVERY EQUIPMENT
Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)
Heat recovery on an immersed crucible aluminium melting furnace. A demonstration at Crompton Parkinson Motors Ltd., Leeds, 15:707 (R;GB)
HEAT RESISTANT MATERIALS
See also HEAT RESISTING ALLOYS
Flame retardant polymeric foams: Manufacturing, applications, and hazards. July 1984-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for July 1984-August 1989, 15:893 (R;US)
High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988, 15:64 (R;US)
HEAT RESISTING ALLOYS
Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)
HEAT SINKS
Flight experiment of thermal energy storage, 15:276 (R;US)
HEAT STORAGE
Flight experiment of thermal energy storage, 15:276 (R;US)
HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT TRANSFER
See also CONVECTION
A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme, 15:512 (J;US)
Acceleration of energy iterations in thermal-hydraulic calculations, 15:449 (J;US)
Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0, 15:142 (R;US)
Evaluation of advanced computer systems for performing system thermal-hydraulic modeling, 15:366 (J;US)
Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)

HEAT TRANSMISSION
See HEAT TRANSFER
HEATERS
Quality-assurance procedures: Method 28A measurement of air-to-fuel ratio and minimum burn rate for wood-fired appliances, 15:1267 (R;US)
HEATING
See also PLASMA HEATING
SPACE HEATING
The DWPF Melter proposed heat up sequence, 15:178 (R;US)
HEAVY ION REACTIONS
See also NICKEL 58 REACTIONS
OXYGEN 16 REACTIONS
OXYGEN 18 REACTIONS
SILICON 28 REACTIONS
Fortran programmes for the calculation of single-particle quantities in heavy-ion collisions in a two-center basis, 15:1701 (RA;DD)
Fortran programs KASSAMBA and STRIDEM, 15:1811 (RA;DD)
HOT - a Fortran program for calculation of fast nucleon emission from a hot zone, 15:1810 (RA;DD)
High energy gamma-ray production in nuclear reactions, 15:221 (R;FR)
Linear momentum transfer in the reaction of 64–269 MeV ^{3}He with ^{238}U, 15:1821 (J;US)
PEP (promptly emitted particles) - a Fortran program for calculation of fast nucleon emission in heavy-ion reactions, 15:1809 (RA;DD)
Physics at SIS/ESR, 15:1775 (R;DE)
HEAVY IONS
Gas detectors for heavy ions, 15:1164 (R;FR;In French)
HEAVY OILS
See PETROLEUM
HELIUM
Accurate *ab initio* calculation on the low-energy elastic scattering of electrons from helium, 15:1712 (J;US)
Low temperature cryoprobe, 15:1015 (P;US)
Resonantly enhanced above-threshold ionization of helium, 15:1705 (J;US)
Spin effects in slow (H-He)$^{+}$ collisions, 15:1714 (J;US)
Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles, 15:1711 (J;US)
HELIUM 3
Improved method for determination of helium-4 in helium-3 by mass spectrometry. Report of Investigations/1989, 15:933 (R;US)
HELIUM 3 TARGET
Reaction ^{3}He(π^{+},*pp*)*p* at T_{π}=350 and 500 MeV, 15:1783 (J;US)
HELIUM 4
See also HELIUM II
Improved method for determination of helium-4 in helium-3 by mass spectrometry. Report of Investigations/1989, 15:933 (R;US)
HELIUM II
Experiments with metallic and ceramic porous media. Report 30 December 1988, 15:988 (R;US)
HELIUM IONS
Spin effects in slow (H-He)$^{+}$ collisions, 15:1714 (J;US)
HELIUM ISOTOPES
See also HELIUM 3
HELIUM 4
Separation of helium and hydrogen isotopes by ISS [Isotope Separation System] at the TSTA, 15:1950 (R;US)
HELIUM METHOD
See ISOTOPE DATING
HEMATOPOIETIC SYSTEM
Modulation of lymphopoiesis: Annual report, 15:1424 (R;US)
HERA STORAGE RING
Algorithms for the calorimeter simulation with parametrized showers on the example of the H1 detector, 15:1170 (R;DE;In German)
Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)
HETEROJUNCTIONS
Advances in material/cell/submodule research in the DOE/SERI amorphous silicon research project, 15:258 (BA;US)
III-V compound process development using photoluminescence lifetime, 15:905 (BA;US)
Minority carrier lifetime of GaAs on silicon, 15:906 (BA;US)
HFIR REACTOR
Large break loss-of-coolant accident analyses for the high flux isotope reactor, 15:483 (R;US)
Risk and safety analysis in support of the operation at the High Flux Isotope Reactor at Oak Ridge, 15:484 (R;US)
HIGGS BOSONS
Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?, 15:1751 (J;US)
Higgs bosons in left-right-symmetric models, 15:1752 (J;US)
Higgs decay into Goldstone Bosons, 15:1760 (J;US)
Higgs-boson decay into two gluinos, 15:1757 (J;US)
Possible method in some extensions of the standard model to produce and detect Higgs bosons at hadron colliders, 15:1745 (J;US)
Renormalization-group-improved unitarity bounds on the Higgs-boson and top-quark masses, 15:1759 (J;US)
HIGH ALTITUDE (STRATOSPHERE)
See STRATOSPHERE
HIGH ENERGY PHYSICS
ACP/R3000 processors in data acquisition systems, 15:1209 (J;US)
Real-time applications of neural nets, 15:2009 (J;US)
Research program in elementary particle theory: Outstanding junior investigator program: Progress report for period ending December 31, 1989, 15:1766 (R;US)
Research program in elementary particle theory: Progress report for period ending December 31, 1989, 15:1765 (R;US)
Software for FASTBUS and Motorola 68K based readout controllers for data acquisition, 15:1133 (J;US)
HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY
HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES
HIGH FLUX ISOTOPE REACTOR
See HFIR REACTOR
HIGH PRESSURE COOLANT INJECTION
Utilization of simulation data for control system reliability analysis, 15:462 (J;US)
HIGH TEMPERATURE GAS COOLED AND GRAPHITE MODERATED REACTORS
See HTGR TYPE REACTORS
HIGH VOLTAGE DIRECT CURRENT SYSTEMS
See HVDC SYSTEMS
HIGH-FREQUENCY DISCHARGES
Langmuir probe characteristics in RF glow discharges, 15:1217 (J;US)
HIGH-LEVEL RADIOACTIVE WASTES
Containment
Lead iron phosphate glass as a containment medium for disposal of high-level nuclear waste, 15:197 (P;US)
Ground Disposal
Results of field testing of waste forms using lysimeters, 15:148 (R;US)
Transport properties of radionuclides and hazardous chemical species in soils at the Idaho Chemical Processing Plant, 15:175 (R;US)
Radioactive Waste Disposal
Oversight-a key ingredient in the HLW repository program, 15:186 (J;US)
Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)
Status of the NRC's high-level waste repository licensing program, 15:190 (J;US)
Radioactive Waste Management
Application of QA to R & D support of HLW programs, 15:195 (J;US)
Characteristics of spent fuel and high-level waste, 15:192 (J;US)

Effective sample labeling, 15:167 (R;US)
The role of the Nuclear Regulatory Commission in the management of nuclear waste, 15:189 (J;US)

Radioactive Waste Processing
Economic analysis of projected high-level waste immobilization operations at the Savannah River Plant, 15:137 (RA;US)
Evaporation characteristics of a reprocessing plant HLLW concentrator, 15:187 (J;US)
The DWPF Melter proposed heat up sequence, 15:178 (R;US)

Radioactive Waste Storage
Evaluation and compilation of DOE [Department of Energy] waste package test data: Biannual report, February 1988–July 1988, 15:160 (R;US)

Transport
Demonstration of criticality safety for the modified TN-REG and TN-BRP transport/storage casks, 15:986 (R;US)
Doses to railroad workers from shipments of radioactive materials, 15:205 (J;US)
Estimated routine radiation doses to transportation workers in alternative spent-fuel transportation systems, 15:204 (J;US)

Underground Disposal
Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0, 15:142 (R;US)
Experiences of fitting isotherms to data from batch sorption experiments for radionuclides on tuffs, 15:154 (R;US)
Isotopic effects on solubility-limited mass transfer, 15:156 (R;US)
Results from electromagnetic surface surveys to characterize the Culebra aquifer at the WIPP [Waste Isolation Pilot Plant] site, 15:170 (R;US)
Safeguards issues relevant to geologic disposal of spent nuclear fuels, 15:152 (R;US)
Spent fuel performance in geologic repository environments, 15:168 (R;US)
The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater, 15:138 (R;US)

Vitrification
Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)

Waste Transportation
Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant, 15:127 (R;US)

HIGH-VOLTAGE PULSE GENERATORS
Design of the Los Alamos generator installation, 15:1961 (R;US)

HISTIDINE
Influence of monofluormethylhistidine (MFMH) on the mammary adenocarcinoma M-2, 15:1398 (RA;AR)

HODOSCOPES
Composite charged particle detectors with logarithmic energy response for large dynamic range energy measurements, 15:1207 (J;NL)

HOLMIUM 165 TARGET
Velocity dependence of prompt, high-energy nucleon emission, 15:1822 (J;US)

HOLOGRAPHY
Soft x-ray microscope using Fourier transform holography, 15:1107 (R;US)
Wavelength choice for soft x-ray laser holography of biological samples, 15:1219 (J;US)

HOPE CREEK-1 REACTOR
A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)

HOPE CREEK-2 REACTOR
A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)

HOSE INSTABILITY
Detuning ion hose with a time varying axial magnetic field, 15:1697 (R;US)

HOT PLASMA
Absolute multilayer characterization at high spatial resolution via real-time soft x-ray imaging, 15:1907 (R;US)
Super-transition-arrays: A model for the spectral analysis of hot, dense plasma, 15:1915 (J;US)

HOUSES
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 1, Single-family building technologies, 15:677 (R;US)
Electricity savings and one and two years after weatherization: A study of 1986 participants in Bonneville's Residential Weatherization Program, 15:653 (R;US)
Residential energy efficiency and fuel choice, 15:654 (R;US)
State-of-the-art interior piping systems applications: Single-family buildings. Final report, January 1985-December 1986, 15:100 (R;US)

HPCI
See HIGH PRESSURE COOLANT INJECTION

HTGR TYPE REACTORS
See also AVR REACTOR
[Gas-cooled reactor materials]: Foreign trip report, June 11–16, 1988, 15:382 (R;US)
[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)
[Structural design criteria for HTGR reactors]: Foreign trip report, January 28, 1989–February 5, 1989, 15:385 (R;US)
[Structural design criteria for HTGR reactors]: Foreign trip report, January 29, 1989–February 3, 1989, 15:384 (R;US)

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN CELLS
See ANIMAL CELLS

HVDC SYSTEMS
Model study of the effects of wind on ion current density and electric field at the ground level, 15:314 (R;JP;In Japanese)

HYBRID REACTORS
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

HYDRATATION
See HYDRATION

HYDRATED ELECTRONS
See HYDRATION

HYDRATION
Activity coefficients in aqueous salt solutions: 2, Hydration theory equations, 15:1544 (R;US)

HYDRAULIC CONDUCTIVITY
Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)

HYDRAULIC FLUIDS
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988, 15:64 (R;US)

HYDRAULIC RAMS
See PUMPS

HYDRAULICS
A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme, 15:512 (J;US)
Acceleration of energy iterations in thermal-hydraulic calculations, 15:449 (J;US)
Evaluation of advanced computer systems for performing system thermal-hydraulic modeling, 15:366 (J;US)
Near-wall fluid jet velocity profile measurements using laser speckle velocimetry, 15:456 (J;US)

HYDROCARBON FUEL CELLS
Monolithic solid oxide fuel cell development, 15:658 (RA;US)

HYDROCARBONS
See also BENZENE
POLYCYCLIC AROMATIC HYDROCARBONS
Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986, 15:1268 (R;US)
Laser-induced fluorescence determination of temperatures in low pressure flames, 15:978 (J;US)
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)

Method of inducing surface ensembles on a metal catalyst, 15:15 (P;US)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)

HYDRODYNAMICS
See also MAGNETOHYDRODYNAMICS
Assessment of the nearly implicit solution scheme of RELAP5/MOD2: Numerical viscosity and suppression of oscillations, 15:450 (J;US)

HYDROELECTRIC POWER
DOE hydropower program biennial report 1988–1989: (With updated annotated bibliography), 15:234 (R;US)

HYDROELECTRIC POWER PLANTS
See also SMALL-SCALE HYDROELECTRIC POWER PLANTS
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROFLUORIC ACID
Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)
Interactions between two identical polymer chains studied with first-principles calculations, 15:956 (J;US)
Water spray mitigation of hydrofluoric acid releases, 15:727 (R;US)

HYDROGEN
Analytical evaluation of the electrostatic potential for diatomic molecules, 15:1691 (R;US)
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)
Fundamental properties of spin-polarized quantum systems: Technical progress report, November 1988–October 1989, 15:1692 (R;US)
Hydrogen dissolution in and relesease from nonmetals, 15:838 (J;NL)
Laser-induced fluorescence determination of temperatures in low pressure flames, 15:978 (J;US)
Modeling of hydrogen-air diffusion flame. Interim report, 15:975 (R;US)
Reaction rates of $H(H_2)$, $D(H_2)$, and $H(D_2)$ van der Waals molecules and the threshold behavior of the bimolecular gas-phase rate coefficient, 15:952 (J;US)
Spin effects in slow $(H\text{-}He)^+$ collisions, 15:1714 (J;US)
Study of hydrogen mixing within the Combustion Engineering System 80+ containment, 15:489 (R;US)
Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document, 15:523 (J;US)

HYDROGEN 1 TARGET
Hydrogen interactions in PdH_n ($1 \leq n \leq 4$), 15:867 (J;US)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN FLUORIDES
See HYDROFLUORIC ACID

HYDROGEN FUEL CELLS
Design and performance of an air-cooled ion exchange membrane fuel cell, 15:668 (BA;US)
Electrocatalysts for oxygen electrodes in fuel cells and water electrolyzers for space applications, 15:662 (RA;US)
Hydrogen-oxygen proton-exchange membrane fuel cells and electrolyzers, 15:661 (RA;US)
Hydrogen/oxygen fuel cells with in-situ product water removal, 15:666 (BA;US)
Recent advances in solid polymer electrolyte fuel cell technology with low platinum loading electrodes, 15:659 (RA;US)

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IONS
See also HYDROGEN IONS 1 PLUS
Incoherent scatter detection of downward proton fluxes into the ionospheric F-region over Arecido during July 1986 solar minimum, 15:1668 (RA;BR)

HYDROGEN IONS 1 PLUS
Spin effects in slow $(H\text{-}He)^+$ collisions, 15:1714 (J;US)

HYDROGEN ISOTOPES
See also DEUTERIUM
TRITIUM
Separation of helium and hydrogen isotopes by ISS [Isotope Separation System] at the TSTA, 15:1950 (R;US)
Some considerations of "cold fusion" including the calculation of fusion rates in molecules of hydrogen isotopes, 15:1885 (R;US)

HYDROGEN NITRATES
See NITRIC ACID

HYDROGEN SULFIDES
Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)

HYDROLOGY
Hydrology and radionuclide migration at the Nevada Test Site, 15:171 (R;US)

HYDROMAGNETIC WAVES
See also MAGNETOACOUSTIC WAVES
Hydromagnetic phenomena at the magnetopause and in the magnetosphere, 15:1632 (RA;BR)

HYDROXYPROPIONIC ACID-ALPHA
See LACTIC ACID

HYPERCUBE COMPUTERS
1000-fold speedup of scientific computations on a 1024 processor hypercube, 15:2000 (B;US)
Highly concurrent dynamic simulation in chemical engineering, 15:1999 (B;US)

I

IAEA SAFEGUARDS
Development of international exemption principles for recycle and reuse, 15:500 (R;US)

ICE
Development of ice self-release mechanisms: Final report, 15:716 (R;US)

ICF DEVICES
Starlight: A stationary inertial-confinement-fusion reactor with nonvaporizing walls, 15:1972 (R;US)
Wideband Nd:glass laser, 15:1038 (BA;US)

ICR HEATING
Experimental evidence of increased electron temperature, plasma potential, and ion energy near an ICRF antenna Faraday shield, 15:1925 (R;US)
ICRF Faraday shield plasma sheath models: Low and high conductivity limits, 15:1924 (R;US)

IDAHO CHEMICAL PROCESSING PLANT
Water filtration problems at the Idaho Chemical Processing Plant Fuel Storage Area, 15:124 (J;US)

IDAHO NATIONAL ENGINEERING LABORATORY
A nuclear reactor alarm display system utilizing AI techniques for alarm filtering, 15:459 (BA;US)
ATHENA AIDE, 15:460 (BA;US)
Development of an accident management expert system for containment assessment, 15:508 (BA;US)
Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory, 15:1318 (R;US)

IGNITION SYSTEMS
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)

IGT WASTE PROCESS
See BIOGAS PROCESS

ILLIAC COMPUTERS
Parallel processors. September 1987-August 1989 (Citations from the COMPENDEX data base). Report for September 1987-August 1989, 15:1994 (R;US)

ILLINOIS
See also CHICAGO
Achieving an energy-secure economy: Options for Illinois and the Midwest, 15:643 (RA;US)
Recycling grants in Illinois: A two year review. Final report, 15:717 (R;US)

ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS

IMAGE INTENSIFIERS
Stopping rules, Bayesian reconstructions and sieves, 15:1214 (R;US)

IMAGE PROCESSING
Brain peeling: Viewing the inside of a laminar three-dimensional solid. Technical report, 15:1394 (R;US)
Position, rotation, and intensity invariant recognizing method, 15:1080 (P;US)

IMIDES
Absorbed dose thresholds and absorbed dose rate limitations for studies of electron radiation effects on polyetherimides, 15:882 (R;US)

IMMUNE REACTIONS
Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report, 15:1421 (R;DE;In German)

IMPURITIES
Control of helium accumulation by fishbones, 15:1921 (R;US)

IN-CORE FUEL MANAGEMENT
See FUEL MANAGEMENT

INCINERATION
See COMBUSTION

INCINERATORS
Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)
Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Transient phenomena in rotary-kiln incineration, 15:736 (R;US)

INCOLOY 800H
Application of the d.c. potential method for continuous crack length measurement in CT samples of Incoloy 800 H at temperatures above 800^{0}C, 15:775 (R;DE;In German)
[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)

INCONEL 617
[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)

INCONEL 718
Hydrogen embrittlement in nickel-hydrogen cells, 15:560 (RA;US)

INDEXES
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Index volume, Subject and author index, 15:676 (R;US)

INDIUM ALLOYS
Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)

INDIUM ANTIMONIDES
Molecular beam epitaxial growth of high-quality InSb on InP and GaAs substrates, 15:885 (R;US)
Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates, 15:886 (R;US)

INDIUM ARSENIDES
Development of a unique laboratory standard: Indium gallium arsenide detector for the 500-1700 nm spectral region. Final report, 15:884 (R;US)
Investigation of charge storage in InAs/AlAsSb quantum well capacitors, 15:1077 (J;US)
Surface morphologies and electrical properties of molecular beam epitaxial InSb and InAs(x)Sb(1-x) grown on GaAs and InP substrates, 15:886 (R;US)

INDIUM PHOSPHIDE SOLAR CELLS
Hydrogen passivation of AlGaAs and GaInP for high efficiency solar cells, 15:265 (BA;US)
Modeling and simulation of InP homojunction solar cells, 15:267 (BA;US)
On-orbit results of the LIPS 3/InP homojunction solar cell experiment, 15:252 (R;US)

INDIUM PHOSPHIDES
Development of a unique laboratory standard: Indium gallium arsenide detector for the 500-1700 nm spectral region. Final report, 15:884 (R;US)

INDOOR AIR POLLUTION
S. 657: A bill Indoor Air Quality Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989, 15:1292 (B;US)
Ventilation and air-quality investigation of the US Geological Survey building, 15:692 (R;US)

INDUCED RADIOACTIVITY
See RADIOACTIVITY

INDUSTRIAL ACCIDENTS
Railroad accident report: Head-on collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with release of hazardous materials near Altoona, Iowa, on July 30, 1988. Irregular report, 15:697 (R;US)

INDUSTRIAL SECTOR
See INDUSTRY

INDUSTRIAL WASTES
See also SPENT LIQUORS
Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments, 15:721 (R;US)
Hazardous-waste-reduction guidelines for environmental-health programs, 15:724 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
Transient phenomena in rotary-kiln incineration, 15:736 (R;US)

INDUSTRY
See also CHEMICAL INDUSTRY
CONSTRUCTION INDUSTRY
ELECTRIC POWER INDUSTRY
FERTILIZER INDUSTRY
FOOD INDUSTRY
METAL INDUSTRY
MINERAL INDUSTRY
NATURAL GAS INDUSTRY
PETROLEUM INDUSTRY
RUBBER INDUSTRY
TEXTILE INDUSTRY
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)

INERTIAL CONFINEMENT
Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)
Status of inertial confinement fusion, 15:1974 (J;US)

The charged particle transport module CIRCE as part of the KATACO code system, 15:1941 (R;DE)

INERTIAL CONFINEMENT FUSION DEVICES
See ICF DEVICES

INFLATIONARY UNIVERSE
Quenching the cosmological constant, 15:1610 (J;NL)

INFORMATION DISSEMINATION
Reports management, 15:2011 (R;US)

INFORMATION SYSTEMS
Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)

INFRARED RADIATION
Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)

INFRARED THERMOGRAPHY
Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989, 15:1070 (R;US)

INJECTION (BEAMS)
See BEAM INJECTION

INSTITUTIONAL SECTOR
Third-party financing option, 15:640 (RA;US)

INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS

INSULATION (ELECTRICAL)
See ELECTRICAL INSULATION

INSULATION (THERMAL)
See THERMAL INSULATION

INSULATORS (ELECTRICAL)
See ELECTRICAL INSULATORS

INTEGRALS
A table of elliptic integrals: Cubic cases, 15:2004 (J;US)

INTEGRATED CIRCUITS
Hybrid wafer-scale processor. Final report, 15 July 1988-14 January 1989, 15:1070 (R;US)
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)
Real-time applications of neural nets, 15:2009 (J;US)
System theoretic models for high-density VLSI (very large scale integration) structures. Final technical report, 15:1979 (R;US)
The effects of heavy particle radiation on semiconductor devices, 15:1211 (R;US)

INTENSIFIERS (IMAGE)
See IMAGE INTENSIFIERS

INTERCONNECTED POWER SYSTEMS
ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)
Simulation model for automatic generation control, 15:321 (R;JP;In Japanese)

INTERFERENCE
Tracking harmonic notch filter, 15:333 (P;US)

INTERFEROMETRY
Digital image processing in flow visualization, 15:1702 (BA;US)

INTERLABORATORY COMPARISONS
The Eastern Environmental Radiation Facility's participation in interlaboratory and intralaboratory comparisons of environmental sample analyses, 1981–1986, 15:1840 (R;US)

INTERMEDIATE VECTOR BOSONS
See also W MINUS BOSONS
W PLUS BOSONS
Z NEUTRAL BOSONS
Jets, W's, and Z's at $\sqrt{s}$ = 1.8 TeV, 15:1720 (R;US)

INTERMETALLIC COMPOUNDS
[Future of electron microscopy]: Foreign trip report, September 11–30, 1989, 15:792 (R;US)
[Modeling and experimental efforts on ordered intermetallic alloys]: Foreign trip report, May 21–June 5, 1988, 15:787 (R;US)
[Physical metallurgy and mechanical behavior of ordered intermetallics]: Foreign trip report, January 19, 1989–February 3, 1989, 15:789 (R;US)

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
RAMJET ENGINES
Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations from the NTIS data base). Report for September 1979-July 1989, 15:744 (R;US)

INTERNAL CONTAMINATION
See RADIONUCLIDE KINETICS

INTERPLANETARY MAGNETIC FIELDS
Interplanetary magnetic phenomena and processes and the resultant control of geomagnetic activity at earth, 15:1639 (RA;BR)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)

INTERPLANETARY SPACE
Correlative analyses for geomagnetic indices, cosmic-ray intensities and sunspot numbers recorded since 1937, 15:1556 (RA;BR)
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988, 15:1602 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)

INTERSECTING BEAMS
See COLLIDING BEAMS

INTERSTELLAR MAGNETIC FIELDS
The case for a primordial galactic field, 15:1549 (RA;FR)

INVENTORIES
Lead management at the INEL [Idaho National Engineering Laboratory], 15:149 (R;US)

INVERSE SCATTERING PROBLEM
Nonlinear waves. Technical report, 15:1877 (R;US)

IODINE
Shock compression studies of condensed matter, 15:947 (R;US)

IODINE 131
Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)

IODINE 132
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)

IODINE 135
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)

IODINE IODIDES
See IODINE

ION BEAM TARGETS
The charged particle transport module CIRCE as part of the KATACO code system, 15:1941 (R;DE)

ION BEAMS
Aspects of broad band electrostatic emissions in the magnetotail, 15:1626 (RA;BR)
Two-beam BGK solution in an inhonogeneous magnetic field, 15:1678 (RA;BR)

ION CYCLOTRON-RESONANCE HEATING
See ICR HEATING

ION DOSIMETRY
Multisegmented ionization chamber dosimetry system for flight ion beams, 15:1208 (J;NL)

ION EXCHANGE
Ion-exchange resins. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:725 (R;US)

ION EXCHANGE MATERIALS
See also LIQUID ION EXCHANGERS
Ion-exchange resins. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:725 (R;US)

ION EXCHANGE MEMBRANES
See ION EXCHANGE MATERIALS
MEMBRANES

ION IMPLANTATION
Model of plasma immersion ion implantation, 15:1861 (J;US)
Substrate heating for the formation of silicon-on-insulator structures by oxygen implantation. Final report, 15:888 (R;US)

ION MICROSCOPY
[Atom probe field-ion microscopy research on silicon carbide whiskers and evaluate the position sensitive atom probe]: Foreign trip report, September 28, 1988–October 9, 1988, 15:1174 (R;US)

ION PLASMA WAVES
Near-equatorial ion-cyclotron phenomenon in upper ionosphere by satellite data, 15:1636 (RA;BR)

ION SOURCES
See also DUOPLASMATRONS
Design features of an axial-geometry, plasma-sputter, heavy negative ion source, 15:1113 (R;US)
Mass spectrometry of liquid metal ion sources, 15:1700 (RA;DD)
Operating experience with the Argonne PIIECR ion source system, 15:1112 (R;US)

ION WAVE INSTABILITY
Ion-ion acoustic waves versus electron-ion acoustic waves, 15:1899 (RA;BR)

ION-ATOM COLLISIONS
Transfer excitation processes in ion-atom collisions at high energies, 15:1710 (J;US)

IONIC REACTIONS
See CHEMICAL REACTIONS
IONS

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
See also BRAGG GRAY CHAMBERS
FISSION CHAMBERS
MULTIWIRE IONIZATION CHAMBERS
Axial ionization chamber for fragment detection, 15:1183 (RA;DD)
Bragg curve ionization chamber, 15:1180 (RA;DD)
Multisegmented ionization chamber dosimetry system for flight ion beams, 15:1208 (J;NL)
Shaping amplifier for Bragg curve spectroscopy, 15:1182 (RA;DD)
Test measurement with a Bragg ionization chamber at the Rossendorf tandem accelerator, 15:1181 (RA;DD)

IONIZATION FRONT ACCELERATORS
Computer control for a particle beam accelerator, 15:1137 (J;US)

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
X RADIATION
A simple model for discounting radiation health effects risks with time, 15:1438 (J;US)
The effect of radiation penetration on DNA single-strand breaks in rat skin explants, 15:1426 (R;US)
Uses of irradiation for inactivation of microorganisms, 15:1439 (J;US)

IONOPHORESIS
See ELECTROPHORESIS

IONOSPHERE
See also E REGION
F REGION
Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report, 15:1618 (R;US)

Airglow
Neutral wind control over plasma bubbles zonal velocites at Brazilian low latitudes, 15:1667 (RA;BR)

Disturbances
Nonlinear wave fronts and ionospheric irregularities observed by HF sounding over a powerful acoustic source, 15:1690 (J;US)

Dynamics
Overview of the ionospheric research at INPE, 15:1620 (RA;BR)

Electrodynamics
Overview of the ionospheric research at INPE, 15:1620 (RA;BR)

Gases
Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT, 15:1654 (RA;BR)

Magnetic Storms
Complex rocket - satellite experiment with plasma injection in magnetic anomaly region, 15:1898 (RA;BR)
Electron density decrease during geomagnetic storms observed by means of two different techniques, 15:1656 (RA;BR)

Plasma
Plasma bubble characteristics as observed by a rocket-borne langmuir probe and a high frequency capacitance probe, 15:1660 (RA;BR)
Poleward propagation of postsunset ionospheric plasma depletions as detected through meridional scanning airglow (λ=630 nm) measurements in Brazil, 15:1669 (RA;BR)

Plasma Diagnostics
Complex rocket - satellite experiment with plasma injection in magnetic anomaly region, 15:1898 (RA;BR)
Plasma bubble characteristics as observed by a rocket-borne langmuir probe and a high frequency capacitance probe, 15:1660 (RA;BR)
Plasma diagnostics package. Volume 2: Spacelab 2 section, part A. Final science report, 15:1904 (R;US)

Plasma Jets
Complex rocket - satellite experiment with plasma injection in magnetic anomaly region, 15:1898 (RA;BR)

Polar Regions
Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT, 15:1654 (RA;BR)

Research Programs
Overview of the ionospheric research at INPE, 15:1620 (RA;BR)

Scintillations
Ionospheric scintillation studies. Final report, October 1984-September 1987, 15:1616 (R;US)

Short Wave Radiation
HF sideband generation in the ionosphere, 15:1689 (J;US)

Sound Waves
Nonlinear wave fronts and ionospheric irregularities observed by HF sounding over a powerful acoustic source, 15:1690 (J;US)

Wave Propagation
Poleward propagation of postsunset ionospheric plasma depletions as detected through meridional scanning airglow (λ=630 nm) measurements in Brazil, 15:1669 (RA;BR)

Whistlers
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)

Wind
Neutral wind control over plasma bubbles zonal velocites at Brazilian low latitudes, 15:1667 (RA;BR)

IONOSPHERIC STORMS
See also SUDDEN IONOSPHERIC DISTURBANCE
Coupling and controls of ionospheric processes in the composite solar-terrestrial system, 15:1637 (RA;BR)

IONS
See also ANTIMONY IONS
BARIUM IONS
CHLORINE IONS
GERMANIUM IONS
HEAVY IONS
HELIUM IONS
HYDROGEN IONS

LITHIUM IONS
MOLECULAR IONS
MULTICHARGED IONS
OXYGEN IONS
PHOSPHORUS IONS
POTASSIUM IONS
SULFUR IONS
THORIUM IONS
URANIUM IONS
Model study of the effects of wind on ion current density and electric field at the ground level, 15:314 (R;JP;In Japanese)

IONS (MOLECULAR)
See MOLECULAR IONS

IOWA
Manson impact structure, a possible site for a Cretaceous-Tertiary (K-T) boundary impact, 15:1486 (RA;US)

IRON
Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV, 15:1806 (R;US)
Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, September 16, 1988–December 15, 1988, 15:6 (R;US)
Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties, 15:770 (R;GB)
Nucleon and nuclear anapole moments, 15:1815 (J;US)
X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)

IRON 54 TARGET
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)

IRON 56 TARGET
A calorimeter for relativistic heavy-ion experiments, 15:1203 (J;NL)

IRON ALLOYS
See also IRON BASE ALLOYS
MARTENSITE
A review of the effects of microalloying constituents on the formation and breakdown of protective oxide scales on high-temperature alloys at temperatures below 700°C, 15:836 (R;US)
Theoretical construction of the magnetic Hamiltonian and zero-temperature anisotropic energy in $Nd_2Fe_{14}B$, 15:810 (J;US)

IRON BASE ALLOYS
See also CAST IRON
STEELS
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation, 15:798 (R;US)

IRON COMPOUNDS
See also FERRITES
IRON OXIDES
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

IRON OXIDES
A k_{eff} search and optimization using noisy differentials, 15:1005 (J;US)
Acidic attack of perfluorinated alkyl ether lubricant molecules by metal oxide surfaces, 15:943 (R;US)

ISING MODEL
A new MCRG [Monte Carlo Renormalization Group] calculation of the critical behavior of the 3d ising model - preliminary results, 15:1878 (R;US)
Collective modes in Ising lattices, 15:1858 (J;US)
Short-range order in Ising-like models with many-body interactions: Description via effective pair interactions, 15:1865 (J;US)

ISOMERS
Thermodynamics and kinetics of complex organic systems: Progress report, March 15, 1989–March 14, 1990, 15:936 (R;US)

ISOTHERM
See ISOTHERMS

ISOTHERMS
Experiences of fitting isotherms to data from batch sorption experiments for radionuclides on tuffs, 15:154 (R;US)

ISOTOPE DATING
Lead-lead dating of migmatitic rocks from the region of the Sao Jose dos Campos, Sao Paulo state, Brazil, 15:1472 (R;BR)

ITER TOKAMAK
A comparison of U.S. and European methods for accident scenario, identificaton, selection and quantification, 15:1936 (R;US)
Development of the passive safety concept for ITER, 15:1932 (R;US)
Operating point selection and burn stability control for the International Thermonuclear Experimental Reactor, 15:1908 (R;US)
TF-ripple loss of suprathermal alphas in ITER: Progress report, 15:1890 (R;US)

J

JAERI
[Japan Atomic Energy Research Institute] progress report, July 1988–June 1989, 15:1808 (R;JP)

JAPAN
Inorganic composite materials in Japan: Status and trends, 15:890 (R;US)
The American Nuclear Society's international student exchange program, 15:435 (J;US)

JAPANESE ATOMIC ENERGY RESEARCH INSTITUTE
See JAERI

JET ENGINE FUELS
Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Impacts of ultra low sulfur diesel fuel production on Navy fuel availability, 15:78 (R;US)
Navy Mobility Fuels Forecasting System Phase 5 report: Jet fuel conversion by Pacific fuel suppliers and impacts on Navy fuel availability, 15:63 (R;US)
Production of jet fuels from coal-derived liquids. Volume 11. Production of advanced endothermic fuel blends from Great Plains Gasification Plant naphtha by-product stream. Final report, September 1987-December 1988, 15:3 (R;US)
Production of jet fuels from coal-derived liquids. Volume 9. Results of bench-scale and pilot-plant testing. Interim report, February 1988-March 1989, 15:2 (R;US)

JET MODEL
Jets, W's, and Z's at $\sqrt{s} = 1.8$ TeV, 15:1720 (R;US)
Space-time effects in the decay of strings by pair-creation, 15:1734 (R;DE)

JETS
Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)

JINR U-400 CYCLOTRON
The present status of the U-400 isochronous cyclotron, 15:1094 (R;SU)

JOSEPHSON JUNCTIONS
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)

JUNCTIONS (SEMICONDUCTOR)
See SEMICONDUCTOR JUNCTIONS

K

K02
See KAONS NEUTRAL LONG-LIVED

KALKAR POWER REACTOR
See SNR REACTOR

KANSAI-1 REACTOR
See MIHAMA-1 REACTOR

KAONS
CP violation in $K_L \rightarrow \pi^0 e^+ e^-$, 15:1733 (R;US)
KAONS 2
See KAONS NEUTRAL LONG-LIVED
KAONS NEUTRAL LONG-LIVED
Detecting hyperphotons in kaon decays, 15:1758 (J;US)
KELP
See SEAWEEDS
KIDNEYS
Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)
KILNS
Heat recovery from a Scotch brick-making kiln. A demonstration project at W.T. Lamb Holdings Ltd. [South Godstone], 15:703 (R;GB)
KINETICS EQUATIONS (REACTOR)
See REACTOR KINETICS EQUATIONS
KNOCK-ON ELECTRONS
See ELECTRONS
KOBAYASHI-MASKAWA MATRIX
How well do we know the Kobayashi-Maskawa matrix?, 15:1753 (J;US)
KRYPTON 81
Isotopically selective optical deflection of a krypton atomic beam, 15:1706 (J;US)
KRYPTON 85
Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1, 15:117 (R;DE;In German)
Isotopically selective optical deflection of a krypton atomic beam, 15:1706 (J;US)
KRYPTON FLUORIDE LASERS
Pulse train amplification in KrF, 15:1039 (BA;US)

L

L REACTOR
Probabilistic evaluation of main coolant pipe break indirectly induced by earthquakes: Savannah River Project L and P Reactors, 15:506 (R;US)
L SHELL
L-shell photoabsorption spectroscopy for solid metals: Ti, V, Cr, Fe, Ni, Cu, 15:1698 (R;US)
LA REINA REACTOR
See RESEARCH REACTORS
LABELLED COMPOUNDS
See also RADIOPHARMACEUTICALS
In vivo stability and inertness of various direct labelled and chelate-tagged protein., 15:1401 (RA;AR)
LABORATORIES
Discharge of ^{41}Ar from a neutron activation analysis facility, 15:545 (J;US)
LABORATORY BUILDINGS
The evolution of seismic design criteria at the Idaho Chemical Processing Plant, 15:1320 (R;US)
LACTIC ACID
Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)
LAMINAR FLOW
Finite difference methods in recirculating flows, 15:1050 (RA;FR)
LAND FILLS
See SANITARY LANDFILLS
LAND OWNERSHIP
Oil Shale Mining Claims Conversion Act. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2089, H.R. 1039, April 22, 1988, 15:110 (B;US)
LAND POLLUTION
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, Mi. (first remedial action), September 1988. Final report, 15:1358 (R;US)
LAND POLLUTION CONTROL
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
LAND RECLAMATION
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987, 15:49 (B;US)
H.R. 1376: A bill to amend titles II, V, and VII of the Surface Mining Control and Reclamation Act of 1977 to make the mining of coal without a permit a criminal offense, and for other purposes. Introduced in the House of Representatives, One Hundredth First Congress, First Session, March 13, 1989, 15:39 (B;US)
H.R. 4804: A bill to amend titles I, II, IV and V of the Surface Mining Control and Reclamation Act of 1977, and to add a new title X, to encourage the remining and reclamation of abandoned mined lands by active mining operations, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 14, 198, 15:41 (B;US)
LAND REQUIREMENTS
Waste Isolation Pilot Plant Land Withdrawal Act of 1987. Hearing before the Subcommittee on Public Lands, National Parks and Forests of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 1272, October 12, 1987, 15:219 (B;US)
LAND USE
Strategy for monitoring the effects of land use change on atmospheric CO_2 concentrations, 15:1257 (R;US)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANGMUIR PROBE
Langmuir probe characteristics in RF glow discharges, 15:1217 (J;US)
LANGUAGES (PROGRAMMING)
See PROGRAMMING LANGUAGES
LANTHANIDES
See RARE EARTHS
LANTHANUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
LANTHANUM CHROMITES
See LANTHANUM OXIDES
LANTHANUM COMPOUNDS
See also LANTHANUM OXIDES
LANTHANUM SILICIDES
Infrared reflectivity spectra of single crystals of La_2CuO_4, 15:850 (J;US)
$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)
LANTHANUM OXIDES
Antiferromagnetic resonance in La_2CuO_{4+y}, 15:858 (J;US)
Bulk superconductivity above 30 K in T^*-phase compounds, 15:861 (J;US)
Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Magnetic ordering in $La_2Cu_{1-x}Zn_xO_{4-y}$, 15:865 (J;US)

Neutron scattering study of the magnetic excitations in metallic and superconducting $La_{2-x}Sr_xCuO_{4-y}$, 15:856 (J;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
Spin dynamics in the two-dimensional quantum antiferromagnet La_2CuO_4, 15:855 (J;US)
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)

LANTHANUM SILICIDES
Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report, 15:883 (R;US)

LASER MATERIALS
Bibliography of Soviet laser developments: January-February 1988, 15:1023 (R;US)

LASER MIRRORS
Optical-phase conjugation. January 1979-March 1989 (Citations from the Compendex data base). Report for January 1979-March 1989, 15:1905 (R;US)

LASER POWER TRANSMISSION
A survey of beam-combining technologies for laser space power transmission, 15:329 (R;US)

LASER RADIATION
$^{12}C^{16}O$ laser frequency tables for the 34.2 to 62.3 THz (1139 to 2079/cm) region, 15:1035 (R;US)

LASER TARGETS
Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)

LASER-PRODUCED PLASMA
Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)
X-ray emission caused by Raman scattering in long-scale-length plasmas, 15:1916 (J;US)

LASERS
See also CHEMICAL LASERS
FREE ELECTRON LASERS
SOLID STATE LASERS
X-RAY LASERS
A survey of beam-combining technologies for laser space power transmission, 15:329 (R;US)
Bibliography of Soviet laser developments: January-February 1988, 15:1023 (R;US)
Inertial fusion research: 1988 Annual technical report, October 1987–September 1988, 15:1927 (R;US)
Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)
Method and apparatus for optical communication by frequency modulation, 15:1046 (P;US)
Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)
[Prospect for wavelength tunable lasers based on vacancy defects in alkaline-earth oxides]: Foreign trip report, September 18, 1989–September 30, 1989, 15:1034 (R;US)

LASL
Health, Safety, and Environment Division annual report, 1988, 15:1284 (R;US)

LATEX
Effect of applied environmental stress on growth, photosynthesis, carbon allocation, and hydrocarbon production in Euphorbia lathyris, 15:226 (RA;US)

LATITUDE EFFECT
Low latitude electric fields, 15:1623 (RA;BR)

LATTICE DEFECTS
See CRYSTAL DEFECTS

LATTICE FIELD THEORY
24×12^3 vs 16×8^3 lattices: Controlling finite-size effects in lattice SU(2) including fermions, 15:1772 (J;US)

LAVA
Deccan volcanism and K-T boundary signatures, 15:1506 (RA;US)
Flood basalt eruptions, comet showers, and mass extinction events, 15:1514 (RA;US)

LAWRENCE BERKELEY LABORATORY
Synchrotron radiation sources to provide new probes of matter, 15:223 (J;US)

LAWRENCE LIVERMORE LABORATORY
A study of the utilization of ex-managers, 15:1977 (R;US)
Energy and Technology Review, September 1989, 15:631 (R;US)

LAYERS
See also BOUNDARY LAYERS
OZONE LAYER
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
Fabrication of a laminate structure for a geophysical electrical simulator, 15:895 (R;US)

LEAD
Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)
Lead exposure: public and occupational health hazards. January 1978-April 1989 (Citations from Pollution Abstracts). Report for January 1978-April 1989, 15:1412 (R;US)
Lead management at the INEL [Idaho National Engineering Laboratory], 15:149 (R;US)
Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea, 15:1258 (R;DE)
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

LEAD 210
Concentrations of ^{226}Ra and ^{210}Pb in agricultural products surrounding the first brazilian mine and mill in Pocos de Caldas, MG, 15:200 (R;BR;In Portuguese)

LEAD BASE ALLOYS
[Lithium and lead-lithium corrosion and chemistry]: Foreign trip report, September 18–26, 1989, 15:793 (R;US)

LEAD METHOD
See ISOTOPE DATING

LEAD OXIDES
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)

LEAD TELLURIDES
Investigation of the influence material on initial stages of epitaxial growth of $Pb_{0.8}Sn_{0.2}Te$ layer during the growing from solution-melt, 15:942 (RA;SU;In Russian)

LEAD-ACID BATTERIES
Laboratory testing of Sonnenschein DF6V180 6 volt traction battery, 15:549 (R;US)
The development of a new sealed bipolar lead-acid battery, 15:586 (BA;US)

LEAK DETECTORS
Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)

LECTINS
Molecular biology of seed storage proteins and lectins, 15:1367 (B;US)

LENSES
Photochromic materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:892 (R;US)

LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

LEPTONS
See also ELECTRONS
NEUTRINOS
New-quark and -lepton production at high-energy e^+e^- colliders, 15:1749 (J;US)
Radiative quark and lepton masses in a left-right gauge model, 15:1746 (J;US)

LEUCOCYTES
See LEUKOCYTES

LEUKEMIA VIRUSES
"Integrase" protein of murine leukemia viruses, 15:1368 (R;US)

LEUKOCYTES
See also LYMPHOCYTES
Differential sensitivity of human leukocyte subpopulations to ultraviolet light, 15:1417 (R;US)
LI-DRIFTED GE DETECTORS
Majority coincidence unit, 15:1199 (RA;DD)
Suppression of low-multiplicity γ-radiation in plunger experiments by means of coincidence technique, 15:1189 (RA;DD)
LIBRARIES
The LAW [Library to Analyze Waste] library: A multigroup cross section library for use in radioactive waste analysis calculations, 15:141 (R;US)
LIE GROUPS
Hamiltonian flows, Su(∞), SO(∞), USp(∞), and strings, 15:1762 (R;US)
Nijenhuis tensor and integrable models, 15:1764 (R;US)
LIGASES
Regulation of ethylene biosynthesis in plants; properties of ACC synthase, 15:1369 (RA;US)
LIGHT
See VISIBLE RADIATION
LIGHT GUIDES
See OPTICAL FIBERS
LIGHT NUCLEI
See also BORON 10
CALCIUM 40
CARBON 12
CARBON 14
DEUTERIUM
FLUORINE 19
HELIUM 3
HELIUM 4
NEON 22
OXYGEN 18
TRITIUM
Second class currents in the μ^--capture by polarized light nuclei, 15:1804 (R;SU)
LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS
LIGHTING SYSTEMS
Lighting management system for local control through the PABX network. A demonstration at Chase Manhattan Bank NA., London, 15:688 (R;GB)
LIGHTNING
Characteristics of electromagnetic wave forms with lightning in winter season, 15:1235 (R;JP;In Japanese)
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
LIGHTNING ARRESTERS
Experimental study of direct lightning hits on power distribution lines, 15:315 (R;JP;In Japanese)
LIMESTONE
SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)
Straw as a fuel for chalk drying. A demonstration at Needham Chalks Ltd. [Ipswich], 15:232 (R;GB)
LINERS
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)
LIPIDS
See also PHOSPHOLIPIDS
Altered regulation of lipid biosynthesis in a mutant of Arabidopsis deficient in chloroplast glycerol-3-phosphate acyltransferase activity, 15:1380 (J;US)
LIQUEFIED NATURAL GAS
Oxidative coupling catalyst research for the conversion of natural gas to liquid fuels, 15:88 (B;US)
LIQUEFIERS
See CONDENSERS
LIQUID ASPHALT
See PETROLEUM RESIDUES
LIQUID EFFLUENTS
See LIQUID WASTES
LIQUID FUELS
See also FUEL OILS
GASOLINE
Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)
Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems, 15:80 (R;US)
Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)
Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)
LIQUID ION EXCHANGERS
Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)
LIQUID METAL COOLANT
See LIQUID METALS
LIQUID METAL COOLED REACTORS
See also LMFBR TYPE REACTORS
Analysis of postulated unscrammed loss of flow in SAFR using SSC, 15:516 (J;US)
Comparison of the effect of insulating blockages on metal and oxide fuel elements, 15:517 (J;US)
The centralized reliability data organization (CREDO) assessment of critical component unavailability in liquid-metal reactors, 15:466 (J;US)
LIQUID METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
LIQUID METALS
Time-dependent free convection in liquid metals, 15:1059 (R;US)
LIQUID SCINTILLATION DETECTORS
Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 15:1160 (R;US)
LIQUID WASTES
See also SPENT LIQUORS
WASTE WATER
Evaporation characteristics of a reprocessing plant HLLW concentrator, 15:187 (J;US)
Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)
Monitoring a liquid waste stream with a delayed-neutron instrument, 15:215 (R;US)
LIQUID-METAL MHD GENERATORS
Development of a wet vapor homogeneous liquid metal MHD power system: Semi-annual report, October 1988–March 1989, 15:655 (R;US)
LIQUIDS
See also COAL LIQUIDS
LIQUID METALS
NATURAL GAS LIQUIDS
Chemical association in simple models of molecular and ionic fluids, 15:955 (J;US)
On the scattering function of simple fluids in finite systems, 15:1741 (J;US)
Structure and dynamics of disordered systems, 15:1829 (R;US)
LITHIUM
On the atomic structure of the Nb/Al_2O_3 interface and the growth of Al_2O_3 particles, 15:804 (J;US)
Reactions at the interface between multi-component glasses and metallic lithium films, 15:805 (J;US)
LITHIUM ALLOYS
[Lithium and lead-lithium corrosion and chemistry]: Foreign trip report, September 18–26, 1989, 15:793 (R;US)
LITHIUM CARBONATES
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)
LITHIUM FLUORIDES
Physicochemical factors influencing LiAsF6 reactivity, 15:568 (BA;US)

LITHIUM IONS
Development of a Li^- ion source, 15:1914 (J;US)
LITHIUM-CHLORINE BATTERIES
Layer formation of lithium and its implications for secondary Li-batteries, 15:566 (BA;US)
LITHIUM-SULFUR BATTERIES
Evaluation of alternate electrolytes for use in Li(Si)/FeS2 thermal batteries, 15:577 (BA;US)
Evaluation of mixed solvent electrolytes for ambient temperature secondary lithium cells, 15:567 (BA;US)
Lithium aluminum sulfur dioxide rechargeable system, 15:570 (BA;US)
Lithium rechargeable cells using inorganic electrolytes, 15:569 (BA;US)
Low-temperature performance of a power-pack for a 2-watt ELT, 15:587 (BA;US)
Rechargeable Li-TiS2 cells of spirally wound design, 15:571 (BA;US)
LIVER
Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)
LLNL ADVANCED TEST ACCELERATOR
CAMAC control of diverse data acquisition instrumentation, 15:470 (J;US)
LMFBR TYPE REACTORS
See also EBR-2 REACTOR
ENRICO FERMI-1 REACTOR
SNR REACTOR
A new balance-of-plant model for the SASSYS-1 LMR systems analysis code, 15:391 (R;US)
An improved steam generator model for the SASSYS code, 15:393 (R;US)
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
Improvements in fabrication of metallic fuels, 15:113 (R;US)
Three-dimensional bowing analysis of radial reflector assemblies in advanced LMRS, 15:390 (R;US)
LNG
See LIQUEFIED NATURAL GAS
LOAD MANAGEMENT
An expert system for PWR core operation management, 15:467 (J;US)
Simulation model for automatic generation control, 15:321 (R;JP;In Japanese)
LOADING (REACTOR)
See REACTOR FUELING
LOCA
See LOSS OF COOLANT
LOCAL GROUP
See GALAXIES
LONG WAVE RADIATION
VLF wave phenomena inside the plasmasphere and at the upper ionosphere, 15:1633 (RA;BR)
LONGWALL MINING
Trends in coal-mine-dust exposures for longwall miners: 1981-1987, 15:28 (R;US)
LOS ALAMOS SCIENTIFIC LABORATORY
See LASL
LOSS OF COOLANT
Event sequence of a severe accident in a single-unit CANDU reactor, 15:534 (J;US)
Maanshan small-LOCA analysis, 15:537 (J;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)
Pre-test calculation of reflooding experiments with wider lattice in APWR-geometry (FLORESTAN 2) using the advanced computer code FLUT-FDWR, 15:492 (R;DE)
LOSS OF FLOW
Analysis of postulated unscrammed loss of flow in SAFR using SSC, 15:516 (J;US)
LOW FREQUENCY RADIATION
See LONG WAVE RADIATION
LOW PRESSURE
Electrical breakdown in vacuum: Working group report, 15:997 (R;US)
LOW-LEVEL RADIOACTIVE WASTES
Environmental monitoring annual report for the Tumulus Disposal Demonstration Project: Fiscal year 1988, 15:164 (R;US)
Grout Treatment Facility dangerous waste permit application: Engineering reports: Supplement 1, 15:146 (R;US)
Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)
Integrating radwaste treatment equipment into radwaste processing systems, 15:474 (J;US)
Low-level waste management, 15:191 (J;US)
Pyramiding tumuli waste disposal site and method of construction thereof, 15:198 (P;US)
Regulating the disposal of low-level radioactive waste: A guide to the Nuclear Regulatory Commission's 10 CFR part 61, 15:158 (R;US)
Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1988: Report to Congress in Response to Public Law 99-240, 15:143 (R;US)
Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)
The role of the Nuclear Regulatory Commission in the management of nuclear waste, 15:189 (J;US)
LUBRICANTS
Acidic attack of perfluorinated alkyl ether lubricant molecules by metal oxide surfaces, 15:943 (R;US)
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988, 15:64 (R;US)
LUNAR MATERIALS
The electrochemical generation of useful chemical species from lunar materials, 15:555 (RA;US)
LWR TYPE REACTORS
See WATER COOLED REACTORS
LYMPHATIC SYSTEM
Modulation of lymphopoiesis: Annual report, 15:1424 (R;US)
LYMPHOCYTES
Investigations into the effect of immunostimulating drugs on the immune system of irradiated experimental animals. Final report, 15:1421 (R;DE;In German)
LYMPHOID CELLS
See LYMPHOCYTES
LYSIMETERS
Results of field testing of waste forms using lysimeters, 15:148 (R;US)

M

MA 754
See NICKEL BASE ALLOYS
MA 956
See IRON BASE ALLOYS
MACERALS
Analysis and comparison of two Victorian Brown Coal resinite samples, 15:18 (R;US)
MAGELLANIC CLOUDS
The search for absorption of 1 keV X-rays by the Small Magellanic Cloud, 15:1590 (R;US)
MAGMA
Dynamics of exploding magma chambers: Implications for K-T volcanism and mass extinctions, 15:1518 (RA;US)
MAGNESIUM BASE ALLOYS
Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)

MAGNESIUM FLUORIDES
Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)
MAGNET COILS
[Production of coils for magnets of European colliders]: Foreign trip report, September 25, 1989–September 27, 1989, 15:1119 (R;US)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC COILS
See MAGNET COILS
MAGNETIC FIELDS
See also GEOMAGNETIC FIELD
INTERPLANETARY MAGNETIC FIELDS
INTERSTELLAR MAGNETIC FIELDS
Detuning ion hose with a time varying axial magnetic field, 15:1697 (R;US)
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 1, User's manual, 15:309 (R;US)
Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)
MAGNETIC PROPERTIES
Non-intrusive verification: Revision 1, 15:1234 (R;US)
MAGNETIC SHIELDING
Determination of ICRF antenna fields in the vicinity of a 3-D Faraday shield structure, 15:1923 (R;US)
Electron heating and static sheath enhancement in front of energized rf antennas, 15:1926 (R;US)
MAGNETIC STARS
Publications of the Observatory of the University of Michigan. Volume 12, no. 2: Wavelength identifications in the magnetic CP star HR 4816 (HD 110066), 15:1605 (B;US)
MAGNETIC STORMS
Boundary-layer dynamics in the description of magnetospheric substorms, 15:1541 (R;US)
Daily asymmetry of magnetic storms of analytical methods, 15:1642 (RA;BR;In Spanish)
Effects of electrical inhomogenetties on short period geomagnetic variations, 15:1644 (RA;BR)
Failed connexion between flares and geomagnetic storms, 15:1679 (RA;BR)
Field longitudinal assymmetry model for geomagnetic storms, 15:1643 (RA;BR;In Portuguese)
Geomagnetic storm effects on radiowave absorption in the geomagnetic anomaly region, 15:1670 (RA;BR)
Low ionosphere electron density profiles for the Antartic and south Atlantic geomagnetic anomaly regions associated to PCA events, 15:1651 (RA;BR)
Periodicities in the atmospheric electric field measured at the South Atlantic geomagnetic Anomaly, 15:1680 (RA;BR)
Solar wind streams, magnetospheric substorms and El Nino, 15:1564 (RA;BR)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
VLF transmissions phenomena observed in the Antarctic peninsula, 15:1666 (RA;BR)
MAGNETOACOUSTIC WAVES
Absolute stability in a low density electron heat conducting plasma in strong magnetic fields, 15:1900 (RA;BR)
MAGNETOHYDRODYNAMIC WAVES
See HYDROMAGNETIC WAVES
MAGNETOHYDRODYNAMICS
MHD simulation in space plasma, 15:1685 (RA;BR)
MAGNETORESISTANCE
Magnetotransport studies of epitaxial Cr thin films, 15:764 (R;US)
MAGNETOSONIC WAVES
See MAGNETOACOUSTIC WAVES
MAGNETOSPHERE
See EARTH MAGNETOSPHERE
MAINTENANCE
See also REACTOR MAINTENANCE
Lessons learned in a systemwide implementation of RCM, 15:306 (J;US)
MAINTENANCE FACILITIES
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
MALIGNANCIES
See NEOPLASMS
MAN
A simple model for discounting radiation health effects risks with time, 15:1438 (J;US)
Optimizing procedures for a human genome repository: Project summary, 15:1391 (R;US)
MAN-MACHINE SYSTEMS
Using object-oriented development to support prototyping, 15:1998 (R;US)
MANGANESE 54
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)
MANGANESE ALLOYS
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
MANGANESE COMPOUNDS
Paramagnetic neutron scattering from Pd_2MnSn, 15:808 (J;US)
MANY-BODY PROBLEM
See also TWO-BODY PROBLEM
Calculation of ground states for many-fermion systems, 15:1882 (J;US)
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARS PLANET
Experimental study of atmospheric gases by electron impact technique, 15:1557 (RA;BR)
Glass: a source of data leading to constraints on the volcanic, impact, and atmospheric histories of Mars, 15:1574 (RA;US)
Isotope Ratio Monitoring Gas Chromatography Mass Spectrometry (IRM-GCMS), 15:1587 (RA;US)
Martian regolith geochemistry and sampling techniques, 15:1573 (RA;US)
Photovoltaic power system operation in the Mars environment, 15:273 (R;US)
MARSHALL ISLANDS
Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll, 15:1363 (R;US)
MARTENSITE
Microstructural evolution of martensitic steels during fast neutron iradiation, 15:1920 (R;US)
MASERS
Microwave emission from relativistic electron beams. Final report, 1 November 1983-31 October 1988, 15:1021 (R;US)
MASS TRANSFER
See also CONVECTION
[Environmental transport of radionuclides]: Foreign trip report, September 14–26, 1989, 15:1285 (R;US)
MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR
See MITR REACTOR
MATERIALS
See also COMPOSITE MATERIALS
HAZARDOUS MATERIALS
HEAT RESISTANT MATERIALS
ION EXCHANGE MATERIALS
LASER MATERIALS
LUNAR MATERIALS
MATRIX MATERIALS
PHOTOCHROMIC MATERIALS
POROUS MATERIALS
RADIOACTIVE MATERIALS

REACTOR MATERIALS
REINFORCED MATERIALS
SEMICONDUCTOR MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS
Application of item and personnel tracking to materials control, 15:216 (R;US)
Digital image processing in flow visualization, 15:1702 (BA;US)
Materials research with ion beams. Simulation and analysis, 15:939 (R;DE;In German)
Returned Solar Max hardware degradation study results, 15:784 (RA;US)
X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)

MATERIALS (ANTIFERROMAGNETIC)
See ANTIFERROMAGNETIC MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (FERROMAGNETIC)
See FERROMAGNETIC MATERIALS

MATERIALS (LUNAR)
See LUNAR MATERIALS

MATERIALS (POROUS)
See POROUS MATERIALS

MATERIALS (REINFORCED)
See REINFORCED MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS HANDLING EQUIPMENT
See also GRABS
REMOTE HANDLING EQUIPMENT
Foam and gel decontamination techniques, 15:967 (R;US)

MATERIALS TESTING
See also NONDESTRUCTIVE TESTING
Principles and methods for the testing of high-performance ceramics. A survey, 15:1063 (R;DE;In German)

MATRICES
See also KOBAYASHI-MASKAWA MATRIX
A block QR factorization algorithm using restricted pivoting, 15:1984 (R;US)
Macrotasking the singular value decomposition of block circulant matrices on the Cray-2, 15:1989 (R;US)

MATRIX MATERIALS
Preparation and evaluation of silicon nitride matrices for silicon nitride-SiC fiber composites. M.S. Thesis Final Technical Report, 15:830 (R;US)

MATTER
See also NUCLEAR MATTER
VOLATILE MATTER
Digital image processing in flow visualization, 15:1702 (BA;US)
Neutron stars: A cosmic hadron physics laboratory, 15:1582 (R;US)

MEASURING INSTRUMENTS
See also BOLOMETERS
CALORIMETERS
DOSEMETERS
LYSIMETERS
MOISTURE GAGES
PYROMETERS
RADIATION DETECTORS
SEISMIC ARRAYS
VELOCIMETERS
Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989, 15:684 (R;US)
Vadose zone monitoring at the radioactive waste management complex, Idaho National Engineering Laboratory, 15:1318 (R;US)

MECHANICAL EFFECTS
See MECHANICAL PROPERTIES

MECHANICAL PROPERTIES
See also FRACTURE PROPERTIES
The metallurgical determinants of toughness as cryogenic temperature, 15:779 (R;US)

MECHANICAL STRUCTURES
Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD), 15:1163 (R;US)
Proceedings of the seventh symposium on energy engineering sciences: Nonlinear mechanics and mechanical systems, 15:1051 (R;US)

MEDICINES
See DRUGS

MEISSNER-OCHSENFELD EFFECT
Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989, 15:980 (R;US)

MELANOCYTES
See ANIMAL CELLS

MELTDOWN
Experimental investigations of the sensitivity of hydrogen-steam-air mixtures with regard to the deflagration-detonation transition, 15:481 (R;DE;In German)

MEMBRANES
See also PHOTOSYNTHETIC MEMBRANES
Effect of fatty acyl chain length and structure on the lamellar gel to liquid-crystalline and lamellar to reversed hexagonal phase transitions of aqueous phosphatidylethanolamine dispersions, 15:1407 (J;US)
Geometrical aspects of the frustration in the cubic phases of lyotropic liquid crystals, 15:1382 (J;US)
Laser flash photolysis as a probe of redox protein-membrane interactions: Effect of binding of spinach plastocyanin and horse cytochrome c to lipid bilayer vesicles on the kinetics of reduction by flavin semiquinone, 15:1379 (J;US)
Selective pervaporation of organics from water, 15:938 (R;DE)
The GTP binding protein-dependent activation and deactivation of cGMP phosphodiesterase in rod photoreceptors, 15:1373 (R;US)
The application of Dow Chemical's perfluorinated membranes in proton-exchange membrane fuel cells, 15:660 (RA;US)

MERCURY
Mercury vacuum cleaner operational test and evaluation, 15:1252 (R;US)

MERCURY PLANET
The strange density of Mercury - Theoretical considerations, 15:1607 (BA;US)

MERCURY TELLURIDES
Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989, 15:880 (R;US)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESOSPHERE
Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)

METAGALAXY
See UNIVERSE

METAL INDUSTRY
Hot knock-out route to austempered ductile iron including an experimental study of the resultant tensile properties, 15:770 (R;GB)
Opportunities for industry to improve its competitive position, 15:639 (RA;US)

METAL-GAS BATTERIES
See also LITHIUM-CHLORINE BATTERIES
NICKEL-HYDROGEN BATTERIES
The electrochemical generation of useful chemical species from lunar materials, 15:555 (RA;US)

METAL-NONMETAL BATTERIES
See also LITHIUM-SULFUR BATTERIES
SODIUM-SULFUR BATTERIES
Advanced high-temperature batteries, 15:562 (RA;US)
Advanced rechargeable sodium batteries with novel cathodes, 15:554 (RA;US)
Advances in ambient temperature secondary lithium cells, 15:563 (RA;US)
Novel nitrogen-based organosulfur electrodes for advanced intermediate temperature batteries, 15:553 (RA;US)

METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS

METALS
See also ACTINIDES
ALKALI METALS
ALUMINIUM
CADMIUM
GALLIUM
GERMANIUM
LEAD
LIQUID METALS
MERCURY
RARE EARTHS
TIN
TRANSITION ELEMENTS
ZINC

Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Exchange coupling in metals as understood then and now, 15:760 (R;US)
Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986, 15:1062 (R;US)
Magnetic and electrical properties, 15:762 (R;US)
Materials Division research and technology accomplishments for FY 87 and plans for FY 88, 15:782 (R;US)
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)
The metallurgical determinants of toughness as cryogenic temperature, 15:779 (R;US)
Theory of the energetics and nonclassical nucleation for martensitic transformations from partially soft lattice modes, 15:767 (R;US)
[Geometrical structural properties in the selvedge region of surfaces of random alloys]: Foreign trip report, July 21–September 30, 1989, 15:794 (R;US)
[Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989, 15:769 (R;US)
[Welding and melting by electron and laser beams]: Foreign trip report, September 11–October 2, 1988, 15:788 (R;US)

METEORITES
Biological Effects
Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)

Biological Evolution
Inducement of heterochronic variation in a species of planktic foraminifera by a Late Eocene impact event, 15:1499 (RA;US)

Biological Extinction
Cretaceous-Tertiary findings, paradigms and problems, 15:1508 (RA;US)
Impact as a general cause of extinction: A feasibility test, 15:1516 (RA;US)
Late Wenlock (middle Silurian) bio-events: Caused by volatile boloid impact/s, 15:1476 (RA;US)
Mass killings and detection of impacts, 15:1502 (RA;US)
Permo-Triassic vertebrate extinctions: A program, 15:1510 (RA;US)

Collisions
Acute effects of a large bolide impact simulated by a global atmospheric circulation model, 15:1530 (RA;US)
Bio-, Magneto- and event-stratigraphy across the K-T boundary, 15:1512 (RA;US)
Biospheric traumas caused by large impacts and predicted relics in the sedimentary record, 15:1513 (RA;US)
Calvin 28 cryptoexplosive disturbance, Cass County, Michigan: Evidence for impact origin, 15:1503 (RA;US)
Computer modeling of large asteroid impacts into continental and oceanic sites: Atmospheric, cratering, and ejecta dynamics, 15:1532 (RA;US)
Darkness after the K-T impact: Effects of soot, 15:1538 (RA;US)
Debate over the Cretaceous-Tertiary boundary, 15:1474 (RA;US)
End-triassic mass extinction event, 15:1485 (RA;US)
Environmental effects of large impacts on the earth; relation to extinction mechanisms, 15:1509 (RA;US)
Evidence for a single impact at the Cretaceous-Tertiary boundary from trace elements, 15:1480 (RA;US)
Global Cretaceous-Tertiary fire: Biomass or fossil carbon, 15:1482 (RA;US)
Global environmental effects of impact-generated aerosols: Results from a general circulation model, 15:1238 (RA;US)
Heavy metal toxicity as a kill mechanism in impact caused mass extinctions, 15:1535 (RA;US)
Impact and extinction signatures in complete Cretaceous-Tertiary (K-T) boundary sections, 15:1527 (RA;US)
Impact as a general cause of extinction: A feasibility test, 15:1516 (RA;US)
Impact production of NO and reduced species, 15:1540 (RA;US)
Impact wave deposits provide new constraints on the location of the K/T boundary impact, 15:1488 (RA;US)
Inducement of heterochronic variation in a species of planktic foraminifera by a Late Eocene impact event, 15:1499 (RA;US)
Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean, 15:1490 (RA;US)
K-T impact(s): Continental, oceanic or both, 15:1523 (RA;US)
Late Wenlock (middle Silurian) bio-events: Caused by volatile boloid impact/s, 15:1476 (RA;US)
Manson impact structure, a possible site for a Cretaceous-Tertiary (K-T) boundary impact, 15:1486 (RA;US)
Mass killings and detection of impacts, 15:1502 (RA;US)
Mass mortality and extraterrestrial impacts, 15:1492 (RA;US)
Mineralogical and geochemical anomalous data of the K-T boundary samples, 15:1504 (RA;US)
Nitrogen geochemistry of a Cretaceous-Tertiary boundary site in New Zealand, 15:1481 (RA;US)
Oblique impacts: Catastrophic vs. protracted effects, 15:1521 (RA;US)
Plant microfossil record of the terminal Cretaceous event in the western United States and Canada, 15:1507 (RA;US)
Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions, 15:1475 (RA;US)
Proterozoic Bushveld-Vredefort catastrophe: Possible causes and consequences, 15:1479 (RA;US)
Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause, 15:1489 (RA;US)
Western North American Cretaceous-Tertiary (K-T) boundary interval and its content of shock-metamorphosed minerals: Implications concerning the K-T boundary impact-extinction theory, 15:1491 (RA;US)

Computerized Simulation
Computer modeling of large asteroid impacts into continental and oceanic sites: Atmospheric, cratering, and ejecta dynamics, 15:1532 (RA;US)

Craters
Crater size estimates for large-body terrestrial impact, 15:1519 (RA;US)
Mineralogical and geochemical anomalous data of the K-T boundary samples, 15:1504 (RA;US)

Environmental Effects
Acute effects of a large bolide impact simulated by a global atmospheric circulation model, 15:1530 (RA;US)
Biospheric traumas caused by large impacts and predicted relics in the sedimentary record, 15:1513 (RA;US)
Environmental effects of large impacts on the earth; relation to extinction mechanisms, 15:1509 (RA;US)
Mass extinctions in the deep sea, 15:1529 (RA;US)

Meetings
Report on an international workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure, 15:1517 (RA;US)

Toxicity
Heavy metal toxicity as a kill mechanism in impact caused mass extinctions, 15:1535 (RA;US)

Trajectories
Oblique impacts: Catastrophic vs. protracted effects, 15:1521 (RA;US)
METER WAVE RADIATION
See RADIOWAVE RADIATION
METHANE
A simplified representation for the thermal conductivity of fluids in the critical region, 15:949 (J;US)
Chemical and catalytic activation of methane by metal oxide surfaces. Annual report, September 1, 1987-August 31, 1988, 15:227 (R;US)
Melting in multilayer adsorbed films, 15:914 (J;US)
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
METHANOL FUELS
Survey on synthesis technologies of methanol as an alternative fuel, 15:228 (R;JP;In Japanese)
METROPOLITAN AREAS
See URBAN AREAS
MICELLAR-POLYMER FLOODING
See MICROEMULSION FLOODING
MICROBIAL FLORA
See MICROORGANISMS
MICROCHANNEL ELECTRON MULTIPLIERS
Recent advances in detectors for single-photon counting, 15:1169 (R;US)
MICROEARTHQUAKES
The 1988 INEL [Idaho National Engineering Laboratory] microearthquake survey near the western edge of the eastern Snake River Plain, 15:1543 (R;US)
MICROELECTRONICS
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
MICROEMULSION FLOODING
Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report, 1987–1988, 15:51 (R;US)
MICROFLORA
See MICROORGANISMS
MICROORGANISMS
See also VIRUSES
Microbiology of ground water. January 1977-August 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-August 1989, 15:1339 (R;US)
Uses of irradiation for inactivation of microorganisms, 15:1439 (J;US)
MICROPROCESSORS
Application of PCs to a nuclear reactor laboratory course, 15:431 (J;US)
LEOPARD on a personal computer, 15:341 (J;US)
Perturbation, PCs, and the undergraduate, 15:406 (J;US)
MICROSCOPY
See also ELECTRON MICROSCOPY
ION MICROSCOPY
Wavelength choice for soft x-ray laser holography of biological samples, 15:1219 (J;US)
MICROSEISMIC MONITORING
See ACOUSTIC MONITORING
MICROWAVE AMPLIFIERS
See also MASERS
Gigatron, a new technology for microwave power devices, 15:1114 (R;US)
MICROWAVE DISCHARGES
See HIGH-FREQUENCY DISCHARGES
MICROWAVE EQUIPMENT
See also MICROWAVE AMPLIFIERS
SQUID DEVICES
FDA (Food and Drug Administration) Compliance Program Guidance Manual. Section 4. Medical and radiological devices. Irregular report, 15:1465 (R;US)
Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)
MIDLAND-1 REACTOR
Upgrading radiological work practices through employee participation, 15:365 (J;US)
MIDLAND-2 REACTOR
Upgrading radiological work practices through employee participation, 15:365 (J;US)
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MIHAMA-1 REACTOR
A Japanese gadolinia fuel usage and demonstration program, 15:359 (J;US)
MILITARY EQUIPMENT
Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)
MILITARY FACILITIES
Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll, 15:1363 (R;US)
Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report, 15:1390 (R;US)
Hazardous-waste technical-assistance survey, Carswell AFB, Texas. Final report, 16-27 May 1988, 15:730 (R;US)
Proposed Resource Management Plan Amendment/Final Environmental Impact Statement for McGregor Range, 15:1365 (R;US)
MILITARY PERSONNEL
Anthropomorphic phantom radiation dosimetry at 400 m from a fission source, 15:1847 (J;US)
MILITARY STRATEGY
Nuclear/conventional interaction in battlefield operations, 15:1232 (R;US)
The cost effectiveness of modernized US strategic forces, 15:1230 (R;US)
MILLSTONE-2 REACTOR
Fuel consolidation demonstration: Spent-fuel storage area analysis, 15:471 (R;US)
MINE-MOUTH GENERATING PLANTS
See FOSSIL-FUEL POWER PLANTS
MINERAL INDUSTRY
United Kingdom Minerals Tearbook, 1988. Statistical data to 1987, 15:621 (R;GB)
MINERAL OIL
See LUBRICANTS
MINERAL RESOURCES
See also NATURAL GAS DEPOSITS
OIL SHALE DEPOSITS
PETROLEUM DEPOSITS
Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)
State Mining and Mineral Resources Research Institute Program. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2240, June 27, 1988, 15:646 (B;US)
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)
MINERALS
See also FELDSPARS
Price prospects for major primary commodities, 1988-2000. Volume 1. Summary, energy, metals and minerals. Volume 2. Food products, fertilizers, agricultural raw materials, 15:620 (R;US)
MINES
Investigations with the aim of installation a low-level γ-spectrometer, 15:1187 (RA;DD)
MINING
See also COAL MINING
OIL SHALE MINING
State Mining and Mineral Resources Research Institute Program. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on

Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2240, June 27, 1988, 15:646 (B;US)

MISSILE LAUNCHING SITES
Draft environmental impact statement. Proposed actions at US Army Kwajalein Atoll, 15:1363 (R;US)

MITR REACTOR
Development and experimental demonstration of a noise-reduction technique for a nonlinear dynamic system, 15:464 (J;US)

MIXED OXIDE FUELS
Fabrication of solid oxide fuel cell by electrochemical vapor deposition, 15:672 (P;US)

MIXING
Numerical studies of the effects of jet-induced mixing on liquid-vapor interface condensation, 15:1053 (R;US)

MM-0011
See NICKEL BASE ALLOYS

MOBILE POLLUTANT SOURCES
Atmospheric modeling of air pollution. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 15:1276 (R;US)

MODELS (FLOW)
See FLOW MODELS

MODELS (FUNCTIONAL)
See FUNCTIONAL MODELS

MODELS (SCALE)
See SCALE MODELS

MODELS (SHELL)
See SHELL MODELS

MODERATORS
Corrections for graphite-induced problems in N reactor, 15:528 (J;US)

MODES (OSCILLATION)
See OSCILLATION MODES

MODULAR CONSTRUCTION
See MODULAR STRUCTURES

MODULAR STRUCTURES
Modular construction approach for advanced nuclear plants, 15:372 (J;US)
Modularization concepts for advanced nuclear power plants, 15:419 (J;US)

MOESSBAUER SPECTROMETERS
Microprocessor controlled Moessbauer spectrometer, 15:1176 (RA;DD)

MOISTURE GAGES
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)

MOLECULAR FLUORESCENCE SPECTROSCOPY
See FLUORESCENCE SPECTROSCOPY

MOLECULAR IONS
Introduction to dissociative recombination, 15:1694 (R;US)

MOLECULAR ORBITAL MODEL
See MOLECULES

MOLECULE COLLISIONS
Block Lanczos approach combined with matrix continued fraction for the *S*-matrix Kohn variational principle in quantum scattering, 15:954 (J;US)

MOLECULES
See also POLYATOMIC MOLECULES
A program for calculating and plotting soft x-ray optical interaction coefficients for molecules, 15:1215 (R;US)
Analytical evaluation of the electrostatic potential for diatomic molecules, 15:1691 (R;US)

MOLTEN CARBONATE FUEL CELLS
Molten carbonate fuel cell technology improvement: Quarterly technical progress report No. 17 for period ending May 1989, 15:657 (R;US)

MOLTEN METAL-WATER REACTIONS
Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document, 15:523 (J;US)

MOLYBDENUM
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)

MOLYBDENUM 99
Separation of ^{99}Mo from ^{132}Te using thiourea as complexing agent. Application to the separation of ^{99}Mo from the fission products, 15:960 (R;BR)

MOLYBDENUM SILICIDES
Molybdenum disilicide as a component of modern composites for application at high temperatures, 15:887 (TJ;US)

MONITORED RETRIEVABLE STORAGE
Nuclear waste issues. Hearings before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session on H.R. 2888 and H.R. 2967, June 11 and October 16, 1987, 15:182 (B;US)

MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS

MONOCHROMATORS
Performance of a directly water-cooled silicon crystal for use in high-power synchrotron radiation applications, 15:1105 (R;US)

MONTE CARLO METHOD
Uncertainties associated with the use of the KENO Monte Carlo criticality codes, 15:422 (R;US)
Vectorization of Monte Carlo particle transport: An architectural study using the LANL benchmark "GAMTEB", 15:1988 (R;US)

MOON
Cometary and asteroidal impactor flux at the earth, 15:1536 (RA;US)
Solar power for the lunar night, 15:253 (R;US)

MORTALITY
The carcinogenic risks of low-LET and high-LET ionizing radiations, 15:1436 (R;US)

MOS TRANSISTORS
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)

MOTOR VEHICLE ACCIDENTS
A comparative study of six data sources' ability for estimating interstate motor carrier VMT [vehicle miles of travel], 15:1466 (R;US)

MULTICHARGED IONS
$3p^63d^8$–$3p^53d^9$ Transitions in ironlike Sb, 15:1042 (J;US)
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)
Wavelengths and energy levels for Ge xxiv, Ge xxv, and Ge xxvi observed in plasmas produced by line-focus laser irradiation, 15:1044 (J;US)

MULTIPLICATION FACTORS
A k_{eff} search and optimization using noisy differentials, 15:1005 (J;US)
Californium-252-source-driven noise analysis measurements for six interacting safe bottles of aqueous uranyl nitrate, 15:1007 (J;US)

MULTIPROCESSING
See PARALLEL PROCESSING

MULTIPROCESSORS
See ARRAY PROCESSORS

MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS

MULTIWIRE IONIZATION CHAMBERS
Gas detectors for heavy ions, 15:1164 (R;FR;In French)

MULTIWIRE PROPORTIONAL CHAMBERS
See also DRIFT CHAMBERS
Converter multiwire proportional chamber (MWPC) in the multistep avalanche mode, 15:1184 (RA;DD)

MUNICIPAL WASTES
Economical disposal of municipal solid waste with minimal discharges to the atmosphere and maximum recycling of energy and metal values, 15:731 (R;US)
Efficiency of dioxin recovery from fly-ash samples during extraction and cleanup process, 15:25 (R;US)

Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs, 15:737 (R;US)
Hazardous-waste-reduction guidelines for environmental-health programs, 15:724 (R;US)
Municipal waste disposal crisis. Hearings before the Subcommittee on Transportation, Tourism, and Hazardous Materials of the Committee on Energy and Commerce, House of Representatives, One hundredth Congress, First Session, March 19, May 6, and June 5, 1989, 15:740 (B;US)
Municipal waste processing apparatus, 15:1081 (P;US)
Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)
Transient phenomena in rotary-kiln incineration, 15:736 (R;US)

MUON-CATALYZED FUSION
High pressure deuterium-tritium gas target vessels for muon-catalyzed fusion experiments, 15:1884 (R;US)
Measurements of neutron emission induced by muons stopped in metal deuteride targets, 15:1883 (R;US)

MUSCOVITE
Muon induced fission and fission track dating, 15:921 (RA;BR)

MUSEUMS
See EDUCATIONAL FACILITIES

MUTAGENESIS
Mutagenesis - fundamental chemistry, 15:1374 (RA;US)

MWPC
See MULTIWIRE PROPORTIONAL CHAMBERS

N

N CODES
Drying of permeable media: Whitaker's paradox explained, 15:1060 (BA;US)

N-REACTOR
Corrections for graphite-induced problems in N reactor, 15:528 (J;US)
N Reactor external events probabilistic risk assessment, 15:505 (R;US)

NAI DETECTORS
Majority coincidence unit, 15:1199 (RA;DD)
Suppression of low-multiplicity γ-radiation in plunger experiments by means of coincidence technique, 15:1189 (RA;DD)

NAL SYNCHROTRON
See FERMILAB ACCELERATOR

NAPAP
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)

NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR

NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
See NAPAP

NATIONAL BUREAU OF STANDARDS REACTOR
See NBSR REACTOR

NATIONAL GOVERNMENT
S. 2720: A bill requiring the use by the Federal Government of certain vehicles capable of operating on alcohol or natural gas fuels or on electricity in areas not in compliance with the Clean Air Act, and for other purposes. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, August 10, 1988, 15:748 (B;US)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
See NIOSH

NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY

NATIONAL SECURITY
United States military strategy in the Persian Gulf. Study project, 15:45 (R;US)

NATIONAL SYNCHROTRON LIGHT SOURCE
See NSLS

NATURAL GAS
See also LIQUEFIED NATURAL GAS
Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989, 15:99 (B;US)
Gas reburning-sorbent injection for controlling SO_{chi} and NO_{chi} utility boilers, 15:312 (B;US)
H.R. 1476: A bill to amend the Internal Revenue Code of 1986 to clarify the application of the credit for producing fuel from a nonconventional source with respect to gas produced from a tight formation and to make such credit permanent with respect to such gas and gas produced from Devonian shale. Introduced in the House of Representatives, One Hun, 15:94 (B;US)
H.R. 2266: Pipeline Safety Reauthorization Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, April 21, 1988, 15:98 (B;US)
International oil and gas exploration and development activities: Second quarterly report, 15:48 (R;US)
Natural gas annual 1988: Volume 1, 15:91 (R;US)
Natural gas annual 1988: Volume 2, 15:92 (R;US)
S. 2096: Canadian Free Trade Agreement Incentive Equalization Act. Introduced in the Senate of the United States. One Hundredth Congress, Second Session, February 25, 1988, 15:72 (B;US)
S. 625: Natural Gas Regulatory Reform Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 16, 1989, 15:95 (B;US)
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)

NATURAL GAS APPLIANCES
See GAS APPLIANCES

NATURAL GAS DEPOSITS
Analysis of stratigraphic and production relationships of Devonian-shale gas reservoirs in Ohio. Final report, October 1985-November 1988, 15:86 (R;US)
Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report, 15:1324 (R;US)
Federal onshore oil and gas leasing. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress First Session on S. 66, S. 1388, June 30, 1987, 15:76 (B;US)
Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987, 15:49 (B;US)
H.R. 2851: A bill to amend the Mineral Lands Leasing Act of 1920 to reform the onshore oil and gas leasing program. Introduced in the House of Representatives, One Hundredth Congress, First Session, June 30, 1987, October 15, 1987, November 6, 1987, November 20, 1987, 15:75 (B;US)
H.R. 4343: Arctic National Wildlife Refuge Energy Plan Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, March 31, 1988, 15:70 (B;US)
Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)
S. 684: Arctic Coastal Plain Competitive Oil and Gas Leasing Act. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 29, 1989, 15:69 (B;US)

NATURAL GAS DISTRIBUTION SYSTEMS
INGS Pipeline Project, Tennessee Gas Pipeline Company: Environmental assessment, 15:93 (R;US)
Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988, 15:101 (R;US)
State-of-the-art interior piping systems applications: Single-family buildings. Final report, January 1985-December 1986, 15:100 (R;US)

NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS
NATURAL GAS INDUSTRY
Natural gas annual 1988: Volume 1, 15:91 (R;US)
Natural gas annual 1988: Volume 2, 15:92 (R;US)
NATURAL GAS LIQUIDS
Oxidative coupling catalyst research for the conversion of natural gas to liquid fuels, 15:88 (B;US)
NATURAL GAS POLICY ACT
Natural gas contract duration and right of first refusal. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 10, 1988, 15:96 (B;US)
S. 625: Natural Gas Regulatory Reform Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 16, 1989, 15:95 (B;US)
NATURAL GAS WELLS
A simulation study of horizontal, high-angle, and vertical wells in Eastern Devonian shale, 15:89 (BA;US)
Type curves for predicting production performance from horizontal wells in low-permeability gas reservoirs, 15:90 (BA;US)
NATURAL GASOLINE
See NATURAL GAS LIQUIDS
NATURAL URANIUM
Tramp uranium, 15:542 (J;US)
NATURE RESERVES
Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)
Mt. Trumbull and Mt. Logan wilderness management plan. Draft report, 15:623 (R;US)
NBSR REACTOR
NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988, 15:932 (R;US)
NEGATONS
See ELECTRONS
NEGATRONS
See ELECTRONS
NEODYMIUM ALLOYS
Theoretical construction of the magnetic Hamiltonian and zero-temperature anisotropic energy in $Nd_2Fe_{14}B$, 15:810 (J;US)
NEODYMIUM LASERS
Analysis of Nd3+:glass, solar-pumped, high-powr laser systems, 15:1031 (R;US)
End-pumped Nd:BEL laser performance. Professional paper, 15:1020 (R;US)
Long-pulse operation of a Nd:glass laser, 15:1037 (BA;US)
Nd:BEL laser pumped by laser diodes, 15:1019 (R;US)
Polarization feedback laser stabilization, 15:1047 (P;US)
Wideband Nd:glass laser, 15:1038 (BA;US)
NEODYMIUM OXIDES
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Pressure dependence of the Cu magnetic order in $RBa_2Cu_3O_{6+x}$, 15:860 (J;US)
NEON 22
Double Gamow–Teller strength in nuclei, 15:1813 (J;US)
NEOPLASMS
See also CARCINOMAS
GLIOMAS
Amplification of oncogenes in early-stage, radiation-induced rat skin tumours, 15:1370 (R;US)
The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990, 15:1425 (R;US)
NEPTUNIUM
Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium, 15:919 (TG;US)
NEPTUNIUM FLUORIDES
Core-level binding energy shifts of the light actinide tetrafluorides and dioxides, 15:1693 (R;US)
NET TOKAMAK
NET model coil test possibilities in the TOSKA TWIN configuration, 15:1942 (R;DE)
NETWORKS (COMPUTER)
See COMPUTER NETWORKS
NEUTRAL BEAM SOURCES
Applications of neutral beam and RF technologies, 15:1973 (J;US)
NEUTRAL PARTICLES
Rate for annihilation of galactic dark matter into two photons, 15:1592 (R;US)
NEUTRAL-PARTICLE TRANSPORT
See also NEUTRON TRANSPORT
PHOTON TRANSPORT
Some geometric modeling and tracking codes for Monte Carlo particle transport including direction biasing techniques, 15:1220 (J;US)
NEUTRINO DETECTION
Neutrinos, dark matter and low temperature detectors, 15:1726 (R;FR)
NEUTRINOS
See also COSMIC NEUTRINOS
SOLAR NEUTRINOS
Model dependence of astrophysical lower bounds on the neutrino mass, 15:1612 (J;US)
Radiative quark and lepton masses in a left-right gauge model, 15:1746 (J;US)
NEUTRON ABSORBERS
Guidance on the use of fixed neutron absorbers, 15:452 (R;US)
NEUTRON BOMBS
See ENHANCED RADIATION WEAPONS
NEUTRON CAPTURE
See NEUTRON REACTIONS
NEUTRON CAPTURE THERAPY
A neutron spectrometer for neutron energies between 1 eV and 10 keV, 15:1202 (J;US)
PBF/BNCT [Power Burst Facility/Boron Neutron Capture Therapy] Program for cancer treatment: Bulletin, 15:1428 (R;US)
PBF/BNCT [power burst facility/boron neutron capture therapy] program for cancer treatment: Volume 3, No. 6, 15:1429 (R;US)
PBF/BNCT program for cancer treatment: Volume 3, No. 7, Bulletin, 15:1430 (R;US)
NEUTRON DETECTORS
See also FISSION CHAMBERS
FISSION FOIL DETECTORS
Fast trigger for neutron time-of-flight measurement, 15:1195 (RA;DD)
Maintenance neutron coincidence counter manual, 15:1167 (R;US)
Theoretical analysis of reactivity measurement with the ^{252}CF source ratio method, 15:423 (R;US)
NEUTRON DIFFUSION EQUATION
Hypercube applications of the x-y geometry nodal method for the neutron diffusion equation, 15:439 (J;US)
Numerical solution of the two-dimensional space-time diffusion equations, 15:443 (J;US)
NEUTRON ECONOMY
See NEUTRON FLUX
NEUTRON FLUX
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
NEUTRON FLUX DENSITY
See NEUTRON FLUX
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON MOISTURE METERS
See MOISTURE GAGES
NEUTRON MONITORS
Application of a neutron moisture gauge to the coal ash layer and to measurement of ground water flow, 15:1162 (R;JP;In Japanese)
Computer-controlled flux monitoring using high-density, self-powered incore detectors, 15:458 (R;US)
NEUTRON RADIOGRAPHY
NBS (National Bureau of Standards) Reactor: Summary of activities July 1987 through June 1988. Technical note, July 1987-June 1988, 15:932 (R;US)

NEUTRON REACTIONS
$^{89}Y+n$ resonances for E=10-740 keV and intermediate structure, 15:1790 (J;NL)
Neutron emission cross sections on ^{184}W at 11.5 and 26 MeV and the neutron-nucleus scattering mechanism, 15:1793 (J;NL)
NEUTRON SOURCES
A 14-MeV beam-plasma neutron source for materials testing, 15:1971 (R;US)
Artificial intelligence search techniques for the optimization of cold source geometry, 15:224 (J;US)
NEUTRON SPECTRA
Calculated proton-induced thick-target neutron and gamma yield spectra for $E_p \leq 100$ MeV, 15:1806 (R;US)
NEUTRON SPECTROMETERS
A neutron spectrometer for neutron energies between 1 eV and 10 keV, 15:1202 (J;US)
NEUTRON STARS
Neutron stars: A cosmic hadron physics laboratory, 15:1582 (R;US)
NEUTRON TRANSPORT
A discrete nodal transport method for cylindrical geometry, 15:1837 (J;US)
The weighted diamond-difference form of nodal transport methods, 15:429 (J;US)
Transport data libraries for incident proton and neutron energies to 100 MeV, 15:1776 (R;US)
NEUTRON TRANSPORT THEORY
Synthetic acceleration of integral-transport scattering iterations, 15:441 (J;US)
NEUTRONS
See also COLD NEUTRONS
FISSION NEUTRONS
A proposed method of measuring the electric-dipole moment of the neutron by ultracold neutron interferometry, 15:1779 (R;US)
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Fortran code for the calculation of 'realistic' distributions of neutrons produced in hydrogen-isotope reactions, 15:1831 (RA;DD)
NEW YORK
Groundwater resources on Long Island. Joint hearing before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science, Space, and Technology, US House of Representatives and the Subcommittee on Water Resources, Transportation, and Infrastructure of the Committee on Environment and Public Works, US Senate,, 15:1361 (B;US)
NEW ZEALAND
Possible world-wide middle Miocene iridium anomaly and its relationship to periodicity of impacts and extinctions, 15:1475 (RA;US)
NEXT EUROPEAN TORUS
See NET TOKAMAK
NGL
See NATURAL GAS LIQUIDS
NICKEL
Arcjet validation of surface catalycity using a viscous shock-layer approach, 15:755 (RA;FR)
Covalent bonding of sulfur on Ni(001): S as a prototypical adsorbate catalytic poisoner, 15:812 (J;US)
Nickel electroplating of steam generator tubes (kiss sleeving process), 15:376 (J;US)
NICKEL 58 REACTIONS
Velocity dependence of prompt, high-energy nucleon emission, 15:1822 (J;US)
NICKEL 78
Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)
NICKEL ALLOYS
See also NICKEL BASE ALLOYS
NICKEL STEELS
Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)
Spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr "Invar" alloys during neutron or ion irradiation, 15:798 (R;US)
NICKEL BASE ALLOYS
Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)
NICKEL OXIDES
$La_2MO_{4+\delta}$(M = Cu, Ni, Co): Phase separation and superconductivity resulting from excess oxygen defects, 15:823 (R;US)
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)
NICKEL STEELS
Quantitative analysis of the precipitation conditions in fine grained structural steel for materials characterization, 15:774 (R;DE;In German)
NICKEL-CADMIUM BATTERIES
Improved nickel electrodes for high temperatures, 15:582 (BA;US)
The importance of batteries in unmanned missions, 15:551 (RA;US)
NICKEL-HYDROGEN BATTERIES
Characterization testing of a 40 Ahr bipolar nickel hydrogen battery, 15:557 (RA;US)
Hydrogen embrittlement in nickel-hydrogen cells, 15:560 (RA;US)
KOH concentration effect on the cycle life of nickel-hydrogen cells. 4: Results of failure analyse, 15:558 (RA;US)
Multi-mission Ni-H2 battery cell for the 1990's, 15:559 (RA;US)
Performance of lightweight nickel electrodes, 15:579 (BA;US)
Short circuit detection and active/passive transitions in nickel hydrogen cells, 15:578 (BA;US)
Small scale bipolar nickel-hydrogen testing, 15:581 (BA;US)
The importance of batteries in unmanned missions, 15:551 (RA;US)
NICKEL-ZINC BATTERIES
Conventional and foam nickel electrodes in the stabilized high energy nickel-zinc battery system, 15:580 (BA;US)
NIGHTGLOW
See AIRGLOW
NIOBIUM
Chemical analysis by X-ray fluorescence, of niobium in high-strength plate steels, 15:927 (R;BR;In Portuguese)
Micron-thin Nb films recovered from Mbar shock pressures, 15:800 (R;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
Solvents extraction of niobium and tantalum, 15:940 (R;BR;In Portuguese)
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)
NIOBIUM ALLOYS
See also NIOBIUM BASE ALLOYS
Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report, 15:881 (R;US)
NIOBIUM BASE ALLOYS
Effect of alloying, rapid solidification, and surface kinetics on the high temperature environmental resistance of niobium. Technical report, November 1985-January 1989, 15:752 (R;US)
Laser cladding of Ni, Nb, and Mg alloys for improved environmental resistance at high temperature. Final report, November 1985-October 1988, 15:754 (R;US)
Perturbed angular correlation study of impurity interactions in a cubic host metal: Hf in Nb, 15:807 (J;US)
Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009, 15:783 (R;US)

NIOBIUM CARBIDES
Dislocation mechanisms, diffusional processes and creep behavior in NbC_{chi}, 15:839 (J;US)
NIOBIUM SELENIDES
Electrochemical behavior of niobium triselenide cathode in lithium secondary cells, 15:572 (BA;US)
NIOSH
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)
NITRATES
See also PLUTONIUM NITRATES
URANIUM NITRATES
URANYL NITRATES
Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)
Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies, 15:1306 (J;US)
NITRIC ACID
Response of marine and freshwater algae to nitric acid and elevated carbon dioxide levels simulating environmental effects of bolide impact, 15:1260 (RA;US)
NITRIC OXIDE
Nitric acid oxide mixing ratio measurements using a rocket launched chemiluminescent instrument. Final technical report, September 1986-October 1987, 15:1259 (R;US)
NITRO COMPOUNDS
See also NITROBENZENE
NITROPHENOL
Information profiles on potential occupational hazards: Nitroparaffins. Draft report (Second), 15:1448 (R;US)
NITROBENZENE
Information profiles on potential occupational hazards: Aminoazobenzenes. Draft report (Second), 15:1451 (R;US)
NITROGEN
Low temperature cryoprobe, 15:1015 (P;US)
Nitrogen geochemistry of a Cretaceous-Tertiary boundary site in New Zealand, 15:1481 (RA;US)
Shock compression studies of condensed matter, 15:947 (R;US)
NITROGEN DIOXIDE
Responses of susceptible subpopulations to nitrogen dioxide. Research report, June 1983-January 1988, 15:1461 (R;US)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
NITROUS OXIDE
Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Gas reburning-sorbent injection for controlling SO_{chi} and NO_{chi} utility boilers, 15:312 (B;US)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)
NITROPHENOL
Information profiles on potential occupational hazards: nitrophenols. Draft report (Second), 15:1453 (R;US)
NITROSO COMPOUNDS
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
NITROUS OXIDE
Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
NOISE THERMOMETERS
Analysis of an R-SQUID noise thermometer. Doctoral thesis, 15:994 (R;FI)
NONAXIAL NUCLEI
See DEFORMED NUCLEI
NONDESTRUCTIVE TESTING
Nondestructive testing: X-ray radiography techniques. January 1975-October 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-October 1987, 15:1065 (R;US)
Nondestructive testing: X-ray radiography techniques. November 1987-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for November 1987-August 1989, 15:1066 (R;US)
NONLINEAR PROBLEMS
Nonlinear waves. Technical report, 15:1877 (R;US)
Numerical bifurcation analysis and parallel processing, 15:1985 (R;US)
NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS
NONLUMINOUS MATTER
Dark matter and the solar neutrino problem: Can particle physics provide a single solution, 15:1568 (R;US)
Distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter dominated universe, 15:1572 (R;US)
Neutrinos, dark matter and low temperature detectors, 15:1726 (R;FR)
Rate for annihilation of galactic dark matter into two photons, 15:1592 (R;US)
NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL
NORTH DAKOTA
Great Plains coal gasification project. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session, September 12, 1988, 15:13 (B;US)
Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:218 (B;US)
NORTHERN IRELAND
See UNITED KINGDOM
NORWAY
Economic consequences of the Chernobyl accident in Norway in 1986 and 1987, 15:535 (J;US)
NPD REACTOR
Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)
NPD-2 REACTOR
See NPD REACTOR
NPD2 ROLPHTON REACTOR
See NPD REACTOR
NPR REACTOR
See N-REACTOR
NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY
NSLS
Research at and operation of the material science x-ray absorption beamline (X-11) at the National synchrotron light source: Annual progress report, 15:1146 (R;US)
NUCLEAR ATTACKS
See NUCLEAR WEAPONS
NUCLEAR CHEMISTRY
Variant for on-line rapid extraction in nuclear-chemical experiments with crown ethers, 15:970 (RA;DD)
NUCLEAR ENERGY
[Production and use of energy from nuclear reactions]: Foreign trip report, July 2–8, 1989, 15:334 (R;US)
NUCLEAR ENGINEERING
Application of PCs to a nuclear reactor laboratory course, 15:431 (J;US)

CANDU-3: Advances in engineering and construction, 15:389 (J;US)
Choosing nuclear engineering: A survey of nuclear engineering undergraduates, 15:412 (J;US)
Collaboration in nuclear engineering education between France and the United States: Participation of French students at Texas A & M University, 15:434 (J;US)
Collaboration in nuclear engineering education between France and the United States: Research opportunities for US students in France, 15:433 (J;US)
Introduction to digital instrumentation and control techniques used in nuclear engineering, 15:463 (J;US)
Perturbation, PCs, and the undergraduate, 15:406 (J;US)
The American Nuclear Society's international student exchange program, 15:435 (J;US)
The University of Stuttgart IKE/University of Arizona student research program, 15:436 (J;US)
The midwest workshop on preparing nuclear engineering professionals, 15:405 (J;US)

NUCLEAR EXPLOSION DETECTION
Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988, 15:1542 (R;DE)

NUCLEAR EXPLOSIONS
Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)
Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah, 15:1229 (R;US)

NUCLEAR FACILITIES
See also FUEL CYCLE CENTERS
FUEL FABRICATION PLANTS
FUEL REPROCESSING PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
ANI [American Nuclear Insurers] support and research facility nuclear liability insurance inspection program, 15:212 (J;US)
Automatic control of a laboratory system, 15:1103 (J;US)
Image reconstruction for a radiation-field mapping system, 15:544 (J;US)
Major issues on establishing an emergency plan in nuclear facilities, 15:488 (TJ;US)
Results of the radiological survey at 7 Hancock Street, Lodi, New Jersey (LJ027), 15:1308 (R;US)
Seismic qualification of safety class components in existing nonreactor nuclear facilites at Hanford Site, 15:115 (R;US)
Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
See also SPENT FUELS
Determination of U^{235} enrichment from nuclear fuel by neutronic activation, 15:930 (R;BR;In Portuguese)
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Reactivity measurements on an experimental assembly of 4.31 wt % ^{235}U enriched UO_2 fuel rods arranged in a shipping cask geometry, 15:128 (R;US)
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)
Summary of experimental and calculational results from the joint USDOE/PNC criticality data development program, 15:119 (R;US)

NUCLEAR MATERIALS MANAGEMENT
A safeguards program to implement DOE requirements, 15:214 (R;US)
Evaluating the contributions of material control to insider protection, 15:217 (R;US)

NUCLEAR MATTER
Collective flow measured with the Plastic Ball, 15:1807 (R;US)
Heavy ions as probes of nuclei far from stability, 15:1780 (R;US)
Proton mean-free path in nuclear matter and in finite nuclei, 15:1824 (J;US)
The creation of high energy densities with antimatter beams, 15:1737 (R;US)

NUCLEAR MEDICINE
See also RADIOLOGY
Focal heavy charged particle irradiation of the mammalian cortex: Temporal pattern of changes followed by magnetic resonance imaging and positron emission tomography, 15:1435 (R;US)

NUCLEAR PHYSICS
Annual report 1985 on nuclear physics activities and applications, 15:1777 (R;DD)
The role of dynamic symmetries and supersymmetries in nuclear physics, 15:1814 (J;US)

NUCLEAR POWER
Nuclear power. CAEC lecturers' manual, 15:472 (R;CS;In Czech)
Nuclear power: A public policy issue, 15:632 (J;US)

NUCLEAR POWER DEMONSTRATION REACTOR CANADA
See NPD REACTOR

NUCLEAR POWER DEMONSTRATION REACTOR-2 CANADA
See NPD REACTOR

NUCLEAR POWER PLANTS
Biological Shields
Simplified determination of radiation environment outside BSW penetrations, 15:543 (J;US)
Compiled Data
Monthly energy review, July 1989, 15:648 (R;US)
Computerized Control Systems
A nuclear reactor alarm display system utilizing AI techniques for alarm filtering, 15:459 (BA;US)
Design Basis Accidents
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
Electric Cables
Radiation effects on power cables for nuclear power plants, 15:454 (J;US)
Expert Systems
An examination of expert systems activities within the nuclear industry, 15:469 (J;US)
Development and assessment of an AI expert system for the monitoring and diagnosis of nuclear power plants, 15:455 (J;US)
Development of an expert system for signal validation, 15:420 (J;US)
Failures
Survey of incidents in West German nuclear power plants in the second quarter of the year 1989, 15:491 (R;DE;In German)
Health Hazards
Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)
Management
Expanding the human-machine interface model to address the effect of leadership and management on performance, 15:408 (J;US)
Improving implementation of corrective actions through a new management consensus process, 15:409 (J;US)
Team performance: Pitfalls and solutions, 15:407 (J;US)
Personnel
Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)
Reactor Accidents
Effectiveness of cleanup criteria relative to an accidental nuclear release, 15:527 (J;US)
Reactor Commissioning
Standard format and content for decommissioning plans for nuclear reactors, 15:501 (R;US)
Reactor Cooling Systems
Development and application of a new material for control of asiatic clams, 15:410 (J;US)
Reactor Maintenance
Optimal preventive maintenance of a nuclear plant subsystem using dynamic programming, 15:411 (J;US)
Optimizing preventive maintenance, 15:418 (J;US)

Reactor Operation
Research activities in the field of human factors: Evaluation and prospects, 15:415 (J;US)
True-personality-assisted self-awareness expert system, 15:416 (J;US)
Turning point in the study of human factors: From centurion to modern man, 15:414 (J;US)
Reactor Physics
Physics and technology of nuclear reactors, 15:426 (R;SU;In Russian)
Reactor Safety
A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme, 15:512 (J;US)
ANSPipe: An IBM-PC interactive code for pipe-break assessment, 15:515 (J;US)
Evaluation of the consequences of containment bypass scenarios, 15:532 (J;US)
Reactor Technology
Physics and technology of nuclear reactors, 15:426 (R;SU;In Russian)
Retrofitting
Generic cost estimates for retrofit activities at nuclear power plants, 15:421 (J;US)
Safety
[The safety of present and future nuclear power plants]: Foreign trip report, September 23, 1989–October 8, 1989, 15:1838 (R;US)
Service Life
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)
Simulators
ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)
Standardization
Modularization concepts for advanced nuclear power plants, 15:419 (J;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTION ANALYSIS
See also DELAYED NEUTRON ANALYSIS
Nuclear micro-beam probe for the investigation of surfaces, 15:934 (RA;DD)

NUCLEAR REACTIONS
See also COMPOUND-NUCLEUS REACTIONS
PHOTONUCLEAR REACTIONS
PRECOMPOUND-NUCLEUS EMISSION
THERMONUCLEAR REACTIONS
CANU workshop on polarization physics at COSY, 15:1125 (R;DE;In German)
[Japan Atomic Energy Research Institute] progress report, July 1988–June 1989, 15:1808 (R;JP)

NUCLEAR REACTORS
See REACTORS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR WASTE POLICY ACTS
Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1988: Report to Congress in Response to Public Law 99-240, 15:143 (R;US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
See also ENHANCED RADIATION WEAPONS
Anthropomorphic phantom radiation dosimetry at 400 m from a fission source, 15:1847 (J;US)
Introduction to the operational nuclear-survivability assessment process. Technical paper, 15:1226 (R;US)
Large-scale problems and supercomputing in the Department of Energy, 15:2005 (J;US)
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
Soviet strategic nuclear doctrine under Gorbachev. Study project, 15:1225 (R;US)

NUCLEAR WINTER
Global environmental effects of impact-generated aerosols: Results from a general circulation model, 15:1238 (RA;US)

NUCLEASES
Mutagenesis - fundamental chemistry, 15:1374 (RA;US)

NUCLEATION
Theory of the energetics and nonclassical nucleation for martensitic transformations from partially soft lattice modes, 15:767 (R;US)

NUCLEI
See also DEFORMED NUCLEI
LIGHT NUCLEI
Nucleon and nuclear anapole moments, 15:1815 (J;US)

NUCLEON REACTIONS
See also NEUTRON REACTIONS
PROTON REACTIONS
Single nucleon removal in relativistic nuclear collisions, 15:1819 (J;US)

NUCLEON-ANTINUCLEON INTERACTIONS
See also PROTON-ANTIPROTON INTERACTIONS
The creation of high energy densities with antimatter beams, 15:1737 (R;US)

NUCLEONS
See also NEUTRONS
PROTONS
Nucleon and nuclear anapole moments, 15:1815 (J;US)
The soudan 2 experiment, 15:1153 (R;US)
Velocity dependence of prompt, high-energy nucleon emission, 15:1822 (J;US)

NUTRIENTS
Sampling and analysis protocols and project description for the Integrated Forest Study, 15:1262 (R;US)

O

OAK RIDGE NATIONAL LABORATORY
See ORNL

OAK RIDGE RESEARCH REACTOR
See ORR REACTOR

OCCUPATIONAL EXPOSURE
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Review and evaluation of recent scientific literature relevant to an occupational standard for ethylene dibromide, 15:1449 (R;US)
Summary report of International Minerals and Chemical Corporation, Phosphate Chemical Complex, New Wales Florida, June 7-11, 1976, 15:1455 (R;US)
Survey for N-nitroso compounds at Crompton and Knowles Corp., Dyes and Chemicals Division, Reading, Pennsylvania, February 20-24, 1978, 15:1271 (R;US)
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
Walk-through survey of Capacitor Production Operation, Westinghouse Electric Corporation, Bloomington, Indiana on December 4, 1975, 15:1454 (R;US)

OCEAN THERMAL POWER PLANTS
Biofouling and corrosion research for marine heat exchangers, 15:279 (R;US)

OCEANIA
Hazardous waste research and development in the Pacific Basin, 15:1297 (R;US)

OCEANS
See SEAS
OCONEE-1 REACTOR
Integrating radwaste treatment equipment into radwaste processing systems, 15:474 (J;US)
OCONEE-2 REACTOR
Integrating radwaste treatment equipment into radwaste processing systems, 15:474 (J;US)
OCONEE-3 REACTOR
Integrating radwaste treatment equipment into radwaste processing systems, 15:474 (J;US)
OCTUPOLES
Reflection asymmetric shapes in nuclei, 15:1799 (R;US)
OFF-GAS SYSTEMS
Comparison of three Kr-85 separation processes of a 350 t/y fuel reprocessing plant with special reference to radiation doses. Vol. 1, 15:117 (R;DE;In German)
OFFICE BUILDINGS
Asbestos survey of Federal Office Building No. 7, US Court of Claims and Court of Customs and Patent Appeals Building, Washington, DC and George H. Fallon Office Building, Baltimore, Maryland, August 29-30, 1973, 15:1273 (R;US)
OFFICIAL TRAVEL
See TRAVEL
OFFSHORE DRILLING
Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report, 15:1324 (R;US)
OHIO
Analysis of stratigraphic and production relationships of Devonian-shale gas reservoirs in Ohio. Final report, October 1985-November 1988, 15:86 (R;US)
OHMIC RESISTANCE
See ELECTRIC CONDUCTIVITY
OIL POLLUTION CONTAINMENT
Artic oil-spill response guide for the alaskan beaufort sea. Final report, 15:68 (R;US)
OIL RESIDUES
See PETROLEUM RESIDUES
OIL SANDS
House Concurrent Resolution 391 [supporting the government of Alberta in a feasibility study for extracting oil from oil sands and the US company which has developed a new solvent extraction technology]. Introduced in the House of Representatives, One Hundredth Congress, Second Session, October 18, 1988, 15:109 (B;US)
OIL SHALE DEPOSITS
H.R. 643: A bill to amend section 37 of the Mineral Leasing Act relating to oil shale claims, and for other purposes. One Hundredth First Congress, First Session, January 24, 1989, May 14, 1989, 15:108 (B;US)
Oil Shale Mining Claims Conversion Act. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, Second Session on S. 2089, H.R. 1039, April 22, 1988, 15:110 (B;US)
OIL SHALE MINING
Oil shale mining and material handling: Considerations for future research and development, 15:104 (R;US)
OIL SHALE PROCESSING PLANTS
Beneficiation-hydroretort processing of US oil shales, engineering study: Volume 3, Final report, 15:106 (R;US)
OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER
OIL SHALES
Acoustical and dielectric loss in natural macromolecular solids, 15:22 (BA;NL)
Beneficiation-hydroretort processing of US oil shales: Volume 2: Final report, 15:105 (R;US)
Novel experimental studies for coal liquefaction: Final report, 15:5 (R;US)
OIL SPILL FINGERPRINTING
See OIL SPILLS
PATTERN RECOGNITION
OIL SPILLS
Artic oil-spill response guide for the alaskan beaufort sea. Final report, 15:68 (R;US)
S. 2643: Oil Pollution Liability and Compensation Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, July 14, 1988, 15:73 (B;US)
OIL WELLS
CO_2 mobility control by carbonate precipitation: A feasibility study, 15:55 (B;US)
Guidelines help select reservoirs for $NaHCO_3$ EOR, 15:60 (J;US)
Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)
The incorporation of the effects of CO_2 solubility in brine into a compositional simulator, 15:57 (B;US)
OIL-IMPORTING COUNTRIES
New era of petroleum trading: Spot oil, spot-related contracts, and futures markets. Technical paper, 15:67 (R;US)
OILS
See also FUEL OILS
High-temperature lubricants and oils. January 1977-August 1988 (Citations from the NTIS database). Report for January 1977-August 1988, 15:64 (R;US)
ON-LINE COMPUTERS
See COMPUTERS
ON-LINE CONTROL SYSTEMS
Survey of adaptive control theory and its applications, 15:322 (R;JP;In Japanese)
ONCOGENES
The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990, 15:1425 (R;US)
ONCOGENIC TRANSFORMATIONS
"Integrase" protein of murine leukemia viruses, 15:1368 (R;US)
ONTARIO PHWR PICKERING-1 REACTOR
See PICKERING-1 REACTOR
ONTARIO PHWR PICKERING-2 REACTOR
See PICKERING-2 REACTOR
OPENINGS
Leak suppression at steam generator man-, hand-, and eyeholes, 15:370 (J;US)
Simplified determination of radiation environment outside BSW penetrations, 15:543 (J;US)
OPERATION
See also REACTOR OPERATION
The human factor in first-year operations, 15:116 (J;US)
OPERATION (REACTOR)
See REACTOR OPERATION
OPERATIONAL AMPLIFIERS
Characterization and development report for the SA3259: An operational amplifier, 15:1074 (R;US)
OPTICAL COMPUTERS
Integrated opto-electronic computing. Final technical report, 1 July 1988-31 January 1989, 15:1069 (R;US)
OPTICAL EQUIPMENT
Photochromic materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:892 (R;US)
OPTICAL FIBERS
Optical fiber sensor technique for strain measurement, 15:1078 (P;US)
OPTICAL SYSTEMS
Method and apparatus for optical communication by frequency modulation, 15:1046 (P;US)
OPTICALLY THICK PLASMA
Equation of state and opacity of dense plasmas, 15:1603 (R;US)
OREGON
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 3 of 4. Final report, 15:610 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon) Volume 2 of 4. Final report, 15:609 (R;US)

Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Oregon) Volume 1 of 4. Final report, 15:608 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Oregon). Volume 4 of 4. Final report, 15:611 (R;US)

ORGANIC CHLORINE COMPOUNDS
See also CHLORINATED ALIPHATIC HYDROCARBONS
CHLORINATED AROMATIC HYDROCARBONS
Best demonstrated available technology (BDAT) background document for K099 (non CBI version). Final report, 15:1351 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Trace substances present as chlorination by-products in drinking and process waters, 15:1342 (J;US)

ORGANIC COMPOUNDS
See also AMINES
HYDROCARBONS
LIPIDS
ORGANIC HALOGEN COMPOUNDS
ORGANIC NITROGEN COMPOUNDS
PROTEINS
A model for the future: Innovative combination of technologies for soil and groudwater VOC [volatile organic compound] remediation, 15:1327 (R;US)
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Hole and antihole profiles in nonphotochemical hole-burned spectra, 15:957 (J;US)
Information profiles on potential occupational hazards: Organic anhydrides. Draft report (Second), 15:1459 (R;US)
Isotope Ratio Monitoring Gas Chromatography Mass Spectrometry (IRM-GCMS), 15:1587 (RA;US)
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)
Methods for the determination of organic compounds in drinking water, 15:1337 (R;US)

ORGANIC HALOGEN COMPOUNDS
See also ORGANIC CHLORINE COMPOUNDS
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)

ORGANIC NITROGEN COMPOUNDS
See also AZO COMPOUNDS
IMIDES
NITRO COMPOUNDS
NITROSO COMPOUNDS
Diisopropyl-ida,Mebrophenyn,Iodophenyn labelled with ^{99m}Tc. Its evaluation in several biological models, 15:965 (RA;AR;In Spanish)
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

ORGANIC WASTES
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)

ORNL
Upgrade of the radioactive air emission systems at Oak Ridge National Laboratory, 15:159 (RA;US)

ORNL RESEARCH REACTOR
See ORR REACTOR

ORNL-PCA REACTOR
Building Shielding Facility quarterly report, April, May, and June 1989, 15:499 (R;US)

ORR REACTOR
Oak Ridge Research Reactor shutdown maintenance and surveillance quarterly report, April, May, and June 1989, 15:477 (R;US)

OSCILLATION MODES
Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator, 15:313 (R;JP;In Japanese)

OSCILLATIONS (PLASMA)
See PLASMA WAVES

OSCILLATORS
Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)

OUTAGES
Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)

OVENS
Heat recovery and energy saving using a Baker Perkins Simplex 2000 bread baking oven. A demonstration at Mothers Pride Bakery. [Nottingham], 15:704 (R;GB)

OXIDATION
See also COMBUSTION
Chemical and catalytic activation of methane by metal oxide surfaces. Annual report, September 1, 1987-August 31, 1988, 15:227 (R;US)

OXIDES
See also ALUMINIUM OXIDES
BARIUM OXIDES
BISMUTH OXIDES
CALCIUM OXIDES
COBALT OXIDES
COPPER OXIDES
ERBIUM OXIDES
GADOLINIUM OXIDES
IRON OXIDES
LANTHANUM OXIDES
LEAD OXIDES
NEODYMIUM OXIDES
NICKEL OXIDES
NITROGEN OXIDES
PLUTONIUM OXIDES
POTASSIUM OXIDES
PRASEODYMIUM OXIDES
SAMARIUM OXIDES
STRONTIUM OXIDES
SULFUR OXIDES
THORIUM OXIDES
URANIUM OXIDES
YTTRIUM OXIDES
ZINC OXIDES
ZIRCONIUM OXIDES
Superconducting components for infrared and millimeter-wave receivers, 15:1011 (J;US)

OXYGEN
Dissociation of O_2 on Cu(001), 15:814 (J;US)
Low-latitude F-region dynamical processes from atomic oxygen nightGlow emissions, 15:1648 (RA;BR)
On the excitation mechanism of oxygen-related emissions in the airglow and aurora, 15:1640 (RA;BR)
The electrochemical generation of useful chemical species from lunar materials, 15:555 (RA;US)
The interaction of oxygen molecules with amorphous Ge, Ge:H, and some Ge:C:H alloys, 15:951 (J;US)

OXYGEN 16 REACTIONS
A calorimeter for relativistic heavy-ion experiments, 15:1203 (J;NL)

OXYGEN 16 TARGET
Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy, 15:1778 (RA;DD)
Photoproduction of pions off nucleons and nuclei, 15:1735 (R;SU)
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)

OXYGEN 18
Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)

OXYGEN 15 REACTIONS
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYGEN IONS
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)
OYSTER CREEK-1 REACTOR
Evaluation of ANF fuel failures in oyster creek, 15:344 (J;US)
The impact of team building and leadership development on nuclear plant performance, 15:345 (J;US)
OZONE
Air pollution: Status of dispute over Alaska oil pipeline air quality controls, 15:77 (R;US)
Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)
Mesospheric ozone depletion due to electron precipitation at the South Atlantic Magnetic Anomaly during geomagnetic storms, 15:1684 (RA;BR)
Ozone measurements in Brazil, 15:1629 (RA;BR)
Sunrise in the ionospheric D-Layer and the total atmospheric ozone content, 15:1659 (RA;BR)
OZONE LAYER
Ozone in the tropics: satellite studies, 15:1622 (RA;BR)
Ozone layer and the NASA airbone Antartic experiment of 1987, 15:1624 (RA;BR)
Present status of the ozone layer, 15:1630 (RA;BR)
S. 491: A bill Stratospheric Ozone and Climate Protection Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1294 (B;US)
S. 503: A bill Chlorofluorocarbons and Halon Reduction Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 2, 1989, 15:1293 (B;US)
Sunrise in the ionospheric D-Layer and the total atmospheric ozone content, 15:1659 (RA;BR)
OZONIZATION
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)

P

P REACTOR
Probabilistic evaluation of main coolant pipe break indirectly induced by earthquakes: Savannah River Project L and P Reactors, 15:506 (R;US)
P-N JUNCTIONS
Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs, 15:1040 (J;US)
PACIFIC GAS DIABLO CANYON-1 REACTOR
See DIABLO CANYON-1 REACTOR
PACIFIC GAS DIABLO CANYON-2 REACTOR
See DIABLO CANYON-2 REACTOR
PACIFIC ISLANDS
See OCEANIA
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PAINTS
Water-based anticorrosion coatings. February 1988-July 1989 (Citations from World Surface Coatings Abstracts). Report for February 1988-July 1989, 15:797 (R;US)
Water-based anticorrosion coatings. January 1980-January 1988 (Citations from World Surface Coatings Abstracts). Report for January 1980-January 1988, 15:796 (R;US)
PALLADIUM
Hydrogen assisted cracking of palladium modified PH 13-8 Mo stainless steel, 15:799 (R;US)
PALLADIUM COMPOUNDS
See also PALLADIUM HYDRIDES
Paramagnetic neutron scattering from Pd_2MnSn, 15:808 (J;US)
PALLADIUM HYDRIDES
Hydrogen interactions in PdH_n ($1 \leq n \leq 4$), 15:867 (J;US)
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)
PAPER INDUSTRY
Kraft recovery boiler physical and chemical processes, 15:699 (B;US)
Technologies for reducing dioxin in the manufacture of bleached wood pulp. Background paper, 15:738 (R;US)
PARABOLIC REFLECTORS
Concentration of off-axis radiation by solar concentrators for space power, 15:285 (R;US)
PARALLEL PROCESSING
1000-fold speedup of scientific computations on a 1024 processor hypercube, 15:2000 (B;US)
A graphics tool to aid in the generation of parallel FORTRAN programs, 15:1986 (R;US)
Brief walk through KAOS (Kent Applicative Operating System), 15:1992 (R;GB)
Computational approaches to discovering semantics in molecular biology, 15:2006 (J;US)
Computational methods and systems for problems in science and engineering. Final report, 1 June 1987-31 May 1988, 15:981 (R;US)
Computers: Massively parallel processors. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:1993 (R;US)
Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)
J-machine: System support for actors. Memorandum report, 15:1978 (R;US)
Parallel processors. September 1987-August 1989 (Citations from the COMPENDEX data base). Report for September 1987-August 1989, 15:1994 (R;US)
Token relabeling in a tagged token data-flow architecture, 15:2007 (J;US)
Utilizing multidimensional loop parallelism on large-scale parallel processor systems, 15:2008 (J;US)
PARTIAL DIFFERENTIAL EQUATIONS
The construction of preconditioners for elliptic problems by substructuring, IV, 15:2002 (J;US)
PARTICLE BOOSTERS
[Shipment of Booster Dipole Vacuum Chambers]: Foreign trip report, August 28, 1989–September 10, 1989, 15:1121 (R;US)
[The AGS Booster Vacuum Systems]: Foreign trip report, September 23, 1989–October 4, 1989, 15:1116 (R;US)
PARTICLE DECAY
CP violation in $K_L \rightarrow \pi^0 e^+ e^-$, 15:1733 (R;US)
The soudan 2 experiment, 15:1153 (R;US)
PARTICLE DISCRIMINATION
Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
PARTICLE IDENTIFICATION
See also PARTICLE DISCRIMINATION
On-line programs for multi-parameter measurements, 15:1201 (RA;DD)
PARTICLE SIZE
Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)
PARTICLE-INDUCED X-RAY EMISSION ANALYSIS
See X-RAY EMISSION ANALYSIS
PARTICLES
See also DROPLETS
NEUTRAL PARTICLES
PARTICULATES

Mobility of colloidal particles in the subsurface: Chemistry and hydrology of colloid-aquifer interactions: International series of interactive seminars summary report, 15:1468 (R;US)

PARTICULATES
Compliance testing of Consumat and Fairchild Hiller silver-reclamation incinerators, Offutt AFB, Nebraska. Final report, 15:1251 (R;US)
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
Measurements of particulates, metals, and organics at a hazardous-waste incinerator. Draft report (Final), 15:739 (R;US)
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)

PASSIVE SOLAR COOLING SYSTEMS
Post-construction activities; Passive and hybrid solar low energy buildings: Design information booklet number eight, 15:685 (R;US)

PASSIVE SOLAR HEATING SYSTEMS
See also TROMBE WALLS
Post-construction activities; Passive and hybrid solar low energy buildings: Design information booklet number eight, 15:685 (R;US)
Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)

PASSIVITY
[Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989, 15:769 (R;US)

PATTERN RECOGNITION
Generalization in backpropagation networks: An empirical study using image data, 15:1995 (R;US)
Track recognition and track reconstruction in the forward drift chamber of SAPHIR, 15:1159 (R;DE;In German)

PCA-ORNL REACTOR
See ORNL-PCA REACTOR

PCB
See CHLORINATED AROMATIC HYDROCARBONS

PEACH BOTTOM-2 REACTOR
The role of NUREG-1150 in accident management, 15:520 (J;US)

PEACH BOTTOM-3 REACTOR
The role of NUREG-1150 in accident management, 15:520 (J;US)

PEAT
Use of peat in wood adhesives, 15:16 (R;FI;In Finnish)

PEATLANDS
See WETLANDS

PECULIAR A-STARS
See MAGNETIC STARS

PEGMATITES
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)

PENICILLIN
Enzyme-based fiber optic sensors, 15:1376 (BA;US)

PENSTOCKS
Report on siphon penstocks for hydroelectric projects: Small-Scale Hydroelectric Power, 15:235 (R;US)

PEP STORAGE RINGS
Study of collective effects in a low-emittance PEP lattice, 15:1141 (R;US)

PERMEABILITY COEFFICIENT (FLUID MECHANICS)
See HYDRAULIC CONDUCTIVITY

PEROVSKITE CRYSTAL STRUCTURE
See CUBIC LATTICES

PEROVSKITES
Researches on amorphous perovskite, 15:1871 (R;JP;In Japanese)

PERSIAN GULF
United States military strategy in the Persian Gulf. Study project, 15:45 (R;US)

PERSONNEL
See also BUILDERS
MILITARY PERSONNEL
REACTOR OPERATORS
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
Doses to railroad workers from shipments of radioactive materials, 15:205 (J;US)
Estimated routine radiation doses to transportation workers in alternative spent-fuel transportation systems, 15:204 (J;US)
Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code, 15:208 (J;US)
Fitness for duty in the nuclear power industry: Responses to implementation questions, 15:403 (R;US)
Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant, 15:127 (R;US)
The human factor in first-year operations, 15:116 (J;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)

PERSONNEL DOSIMETRY
US Department of Energy Laboratory Accreditation Program for personnel dosimetry systems (DOELAP), 15:1839 (R;US)

PERSONNEL FILM DOSIMETRY
See PERSONNEL DOSIMETRY

PESTICIDES
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Pesticide application, 15:722 (R;US)

PETROCHEMICAL FEEDSTOCKS
See PETROCHEMICALS

PETROCHEMICALS
See also PLASTICS
Short-term energy outlook: Annual supplement 1989, 15:636 (R;US)

PETROLEUM
A national laboratory perspective on EOR research and development directions, 15:54 (B;US)
CO_2 mobility control by carbonate precipitation: A feasibility study, 15:55 (B;US)
EIA Domestic Oil Production Estimates. Hearing before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session, April 29, 1987, 15:59 (B;US)
Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report, 1987–1988, 15:51 (R;US)
Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989, 15:99 (B;US)
Improvement of co_2 flood performance. Third annual report. Report for 1 October 1986-30 September 1987, 15:53 (R;US)
International oil and gas exploration and development activities: Second quarterly report, 15:48 (R;US)
International petroleum statistics report, 15:65 (R;US)
Pyrolysis kinetics applied to prediction of oil generation in the Maracaibo Basin, Venezuela, 15:107 (R;US)
Research directions in enhanced oil recovery, 15:58 (B;US)
Reservoir characterization for the CO_2 enhanced oil recovery process: Final report, 15:52 (R;US)
S. 2096: Canadian Free Trade Agreement Incentive Equalization Act. Introduced in the Senate of the United States. One Hundredth Congress, Second Session, February 25, 1988, 15:72 (B;US)
S. 674: A bill to regulate above ground storage tanks having the capacity to store at least one million gallons of petroleum, and for other purposes. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989, 15:83 (B;US)
Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)

The incorporation of the effects of CO_2 solubility in brine into a compositional simulator, 15:57 (B;US)

PETROLEUM COKE
See PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
Baseline environmental survey of the Mississippi, Alabama, Florida (MAFLA) lease areas, CY 1974. Final report, 15:1324 (R;US)
Federal onshore oil and gas leasing. Hearing before the Subcommittee on Mineral Resources Development and Production of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress First Session on S. 66, S. 1388, June 30, 1987, 15:76 (B;US)
Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987, 15:49 (B;US)
H.R. 2851: A bill to amend the Mineral Lands Leasing Act of 1920 to reform the onshore oil and gas leasing program. Introduced in the House of Representatives, One Hundredth Congress, First Session, June 30, 1987, October 15, 1987, November 6, 1987, November 20, 1987, 15:75 (B;US)
H.R. 4343: Arctic National Wildlife Refuge Energy Plan Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, March 31, 1988, 15:70 (B;US)
Mineral resources of the Owl Creek Wilderness Study Area, Hot Springs County, Wyoming, 15:624 (R;US)
S. 684: Arctic Coastal Plain Competitive Oil and Gas Leasing Act. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 29, 1989, 15:69 (B;US)

PETROLEUM INDUSTRY
New era of petroleum trading: Spot oil, spot-related contracts, and futures markets. Technical paper, 15:67 (R;US)

PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
GASOLINE
PETROCHEMICALS
Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems, 15:80 (R;US)
H.R. 5041: A bill to amend the Export Administration Act of 1979 to restrict the export of certain petroleum products from certain oil refineries. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988, 15:71 (B;US)
Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)
Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)

PETROLEUM REFINERIES
H.R. 5041: A bill to amend the Export Administration Act of 1979 to restrict the export of certain petroleum products from certain oil refineries. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 13, 1988, 15:71 (B;US)
Retrofitting of structured packing in an atmospheric distillation column. A demonstration at Phillips Petroleum Ltd., North Tees, 15:61 (R;GB)

PETROLEUM RESIDUES
Effect of prehydrogenation on hydroconversion of Maya residuum, part II: Hydrogen incorporation, 15:62 (B;US)

PETROLEUM STOCKS
See INVENTORIES

PHAEDRUS MIRROR DEVICES
Experimental investigation of ICRF effects, 15:1928 (R;US)

PHANTOMS
Anthropomorphic phantom radiation dosimetry at 400 m from a fission source, 15:1847 (J;US)
Anthropomorphic phantoms, 15:1842 (J;US)
Dose equivalent and phantoms in conventional calibration practice, 15:1844 (J;US)

PHARMACEUTICALS
See DRUGS

PHOSPHATE GLASS
Time resolved fluorescence line narrowing in ytterbium-doped inorganic glasses, 15:903 (BA;US)

PHOSPHATIDES
See PHOSPHOLIPIDS

PHOSPHINIC ACIDS
Application of supported liquid membranes for removal of uranium from groundwater, 15:1345 (R;US)

PHOSPHODIESTERASES
See also NUCLEASES
The GTP binding protein-dependent activation and deactivation of cGMP phosphodiesterase in rod photoreceptors, 15:1373 (R;US)

PHOSPHOLIPIDS
Effect of fatty acyl chain length and structure on the lamellar gel to liquid-crystalline and lamellar to reversed hexagonal phase transitions of aqueous phosphatidylethanolamine dispersions, 15:1407 (J;US)

PHOSPHORUS IONS
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)

PHOTOCHEMISTRY
Simultaneous observations of the OI 5577NM, NaD, O_2 (0,1) and OH (9,4) nightglow emissions at 23^{0}S, 15:1653 (RA;BR)

PHOTOCHROMIC MATERIALS
Photochromic materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:892 (R;US)

PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS

PHOTOMAGNETIC EFFECT
See VISIBLE RADIATION

PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS

PHOTOMULTIPLIERS
Calibration of a photomultiplier array spectrometer, 15:1172 (R;US)

PHOTON TRANSPORT
Transport data libraries for incident proton and neutron energies to 100 MeV, 15:1776 (R;US)
Vectorization of Monte Carlo particle transport: An architectural study using the LANL benchmark "GAMTEB", 15:1988 (R;US)

PHOTON-NUCLEON INTERACTIONS
Testing QCD with milli-TeV electrons, 15:1742 (J;NL)

PHOTONS
Direct-photon searches as tests for unconventional high-energy electroweak interactions, 15:1773 (J;US)

PHOTONUCLEAR REACTIONS
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
Giant $M1$ resonance in ^{120}Sn and the quenching of the nucleon spin g factors, 15:1792 (J;US)

PHOTOPRODUCTION
Comparison between photo- and hadroproduction of rho^0 mesons at the CERN-OMEGA spectrometer, 15:1723 (R;DE;In German)
Studies on the hard scattering in photon-proton reactions in the energy range from 65 to 175 GeV at the CERN Ω spectrometer, 15:1722 (R;DE;In German)

PHOTOSPHERE
Coronal heating with surface waves, 15:1559 (RA;BR)
Energy cancellation and emission in solar atmosphere, 15:1563 (RA;BR;In Portuguese)
Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)

PHOTOSYNTHESIS
Regulation of carbon partitioning in photosynthetic tissue, 15:240 (B;US)
[Bioproductivity and photosynthesis]: Foreign trip report, September 21–30, 1989, 15:243 (R;US)

PHOTOSYNTHETIC BACTERIA
Comparison of structural subunits of the core light-harvesting complexes of photosynthetic bacteria, 15:241 (R;US)
PHOTOSYNTHETIC MEMBRANES
Comparison of structural subunits of the core light-harvesting complexes of photosynthetic bacteria, 15:241 (R;US)
Deprotonation of lipid-depleted bacteriorhodopsin, 15:1383 (J;US)
PHOTOSYNTHETIC REACTION CENTERS
Directed mutagenesis indicates that the donor to P^{+}_{680} in photosystem II is tyrosine-161 of the D1 polypeptide, 15:1384 (J;US)
Spectral, photophysical, and stability properties of isolated photosystem II reaction center, 15:1378 (J;US)
PHOTOVOLTAIC CELLS
See also SOLAR CELLS
Electrochemical and galvanic corrosion effects in thin-film photovoltaic modules, 15:901 (BA;US)
PHOTOVOLTAIC CONVERSION
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)
PHOTOVOLTAIC POWER PLANTS
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)
Comparison of solar photovoltaic and nuclear reactor power systems for a human-tended lunar observatory, 15:272 (R;US)
PHOTOVOLTAIC POWER SUPPLIES
Estimated performance and future potential of solar dynamic and photovoltaic power systems for selected LEO and HEO missions, 15:274 (R;US)
Photovoltaic power system operation in the Mars environment, 15:273 (R;US)
Space station freedom photovoltaic power module design status, 15:278 (R;US)
PHTHALATES
Information profiles on potential occupational hazards: Phthalates. Draft report (Second), 15:1450 (R;US)
PHYSICAL CHEMISTRY
Recent advances in electronic structure theory and their influence on the accuracy of ab initio potential energy surfaces, 15:944 (R;US)
PHYSICAL PROPERTIES
See also MAGNETIC PROPERTIES
Physical and chemical interactions in irradiated water containing DNA, 15:1423 (R;US)
PHYTOPLANKTON
Composition of phytoplankton communities and their contribution to secondary productivity in Carolina Bays on the Savannah River Plant: Year one report, 15:1323 (R;US)
PICKERING-1 REACTOR
Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)
PICKERING-2 REACTOR
Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)
PIGE ANALYSIS
See NUCLEAR REACTION ANALYSIS
PROTON REACTIONS
PIGMENT CELLS
See ANIMAL CELLS
PILES
See FOUNDATIONS
PINES
Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies, 15:1306 (J;US)
PINS (FUEL)
See FUEL PINS
PION PLUS REACTIONS
Reaction $^{3}He(\pi^{+},pp)p$ at T_{π}=350 and 500 MeV, 15:1783 (J;US)
PION REACTIONS
See also PION PLUS REACTIONS
Microscopic *s*-wave optical potential for slow pions scattered by a nucleus, 15:1823 (J;US)
PION-NUCLEON INTERACTIONS
Exchange currents in double charge exchange, 15:1738 (R;US)
PIONS
Photoproduction of pions off nucleons and nuclei, 15:1735 (R;SU)
Theoretical aspects of pion photoproduction off light nuclei, 15:1736 (R;SU)
PIPELINES
See also ALASKA OIL PIPELINE
H.R. 2266: Pipeline Safety Reauthorization Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, April 21, 1988, 15:98 (B;US)
INGS Pipeline Project, Tennessee Gas Pipeline Company: Environmental assessment, 15:93 (R;US)
Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988, 15:101 (R;US)
S. 2770: Oil Pipeline Regulatory Reform Act of 1988. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, September 9, 1988, 15:74 (B;US)
State taxation of interstate natural gas pipeline property. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 30, 1988, 15:97 (B;US)
PIPES
See also PENSTOCKS
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)
ANSPipe: An IBM-PC interactive code for pipe-break assessment, 15:515 (J;US)
Flow-assisted corrosion-consequences for piping, 15:378 (J;US)
Pulsed TIG welding of pipes. Final report, 15:773 (R;DE;In German)
Robot which will investigate the condition of underground pipe. Final report, March 1986-April 1988, 15:101 (R;US)
Shippingport Station Decommissioning Project: Removal of piping and equipment and removal of primary system components, 15:203 (R;US)
PLANETARY ATMOSPHERES
See also PLANETARY MAGNETOSPHERES
Theoretical studies of important processes in planetary and comet atmospheres. Renewel request. Progress report, 1 September 1989-31 October 1990, 15:1578 (R;US)
PLANETARY MAGNETOSPHERES
Effects of corotation electric field on the dynamic of energetic particles in an asymetric planetary magnetic field, 15:1567 (RA;BR)
PLANETS
See also EARTH PLANET
MARS PLANET
MERCURY PLANET
URANUS PLANET
VENUS PLANET
Preliminary results of recent centimetre wavelength radio observation of Mercury, Venus, Mars, Jupiter and Saturn, 15:1558 (RA;BR)
PLANKTON
See also PHYTOPLANKTON
ZOOPLANKTON
Selective extinction of marine plankton at the end of the Mesozoic era: The fossil and stable isotope record, 15:1495 (RA;US)
Strangelove ocean at era boundaries, terrestrial or extraterrestrial cause, 15:1489 (RA;US)
PLANNING
EPA (Environmental Protection Agency) workshop to recommend a minimum set of data elements for ground water: workshop findings report, 15:1352 (R;US)
PLANT CULTIVATION
See CULTIVATION TECHNIQUES
PLANT FOSSILS
See FOSSILS
PLANT GROWTH
Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)
PLANTS
See also ALGAE
SEAWEEDS
Endangered and threatened plants of Edwards, Eglin and Tyndall AFB. Final report, 15:1390 (R;US)

PLANTS (POWER)
See POWER PLANTS

PLASMA
See also COLD PLASMA
HOT PLASMA
LASER-PRODUCED PLASMA
OPTICALLY THICK PLASMA
SOLID-STATE PLASMA
Aspects of broad band electrostatic emissions in the magnetotail, 15:1626 (RA;BR)
Equations of conservation laws in the interplanetary collisionfree plasma, 15:1677 (RA;BR)
Interaction of dust grains with space plasmas, 15:1676 (RA;BR)
Neutral wind control over plasma bubbles zonal velocites at Brazilian low latitudes, 15:1667 (RA;BR)
Plasma bubble characteristics as observed by a rocket-borne langmuir probe and a high frequency capacitance probe, 15:1660 (RA;BR)
Poleward propagation of postsunset ionospheric plasma depletions as detected through meridional scanning airglow (λ=630 nm) measurements in Brazil, 15:1669 (RA;BR)
Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report, 15:1618 (R;US)
Self-focusing of an optical beam in a plasma, 15:1917 (J;US)

PLASMA ACCELERATION
Plasma flow processes within magnetic nozzle configurations, 15:1002 (B;US)

PLASMA CONFINEMENT
See also INERTIAL CONFINEMENT
DIII-D power supply fault system, 15:1913 (J;US)
Status of magnetic fusion, 15:1912 (J;US)

PLASMA DIAGNOSTICS
Automatic control of a laboratory system, 15:1103 (J;US)
DIII-D power supply fault system, 15:1913 (J;US)
Development of a Li^- ion source, 15:1914 (J;US)
Optical-phase conjugation. January 1979-March 1989 (Citations from the Compendex data base). Report for January 1979-March 1989, 15:1905 (R;US)
Perspectives of electron-capture and alternative methods for dianosis of particle sources and acceleration processes, 15:1896 (RA;BR)
Plasma diagnostics package. Volume 1: OSS-1 section. Final science report, 15:1903 (R;US)
Plasma diagnostics package. Volume 2: Spacelab 2 section, part A. Final science report, 15:1904 (R;US)
Plasma diagnostics package. Volume 2: Spacelab 2 section. Part B: Thesis projects. Final science report, 15:1902 (R;US)
Remote controlled signal conditioner and fiber optic data link system development CPRF (Confinement Physics Research Facility), 15:1955 (R;US)

PLASMA DIODES
See THERMIONIC DIODES

PLASMA DRIFT
F-region bubbles: effects of vertical plasma drifts, 15:1649 (RA;BR)
Magnetic activity effects on range type spread-F and vertical plasma drifts at Fortaleza and Huancayo from ionosonde measurements, 15:1646 (RA;BR)

PLASMA HEATING
See also BEAM INJECTION HEATING
Optical-phase conjugation. January 1979-March 1989 (Citations from the Compendex data base). Report for January 1979-March 1989, 15:1905 (R;US)

PLASMA INSTABILITY
Scaling laws for the spectrum of interchange instabilities in the high latitude ionosphere. Interim report, 15:1618 (R;US)

PLASMA OSCILLATIONS
See PLASMA WAVES

PLASMA PRODUCTION
Glow-discharge synthesis of silicon nitride precursor powders, 15:845 (J;US)

PLASMA WAVES
Spatially nonuniform traveling waves bifurcating from single-humped Vlasov equilibria, 15:1910 (J;US)

PLASTIC SCINTILLATION COUNTERS
See PLASTIC SCINTILLATION DETECTORS

PLASTIC SCINTILLATION DETECTORS
NE110 scintillator response to 10-100 MeV carbon ions, 15:1206 (J;NL)
Uniformization of a type of wavelength-shifter light guides for the ZEUS calorimeter, 15:1157 (R;DE;In German)

PLASTICS
See also POLYSTYRENE
Recycling plastic scrap: Injection molding. January 1973-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-August 1989, 15:726 (R;US)

PLATINUM
The equation of state of platinum to 660 GPa (6.6 Mbar), 15:806 (J;US)

PLATINUM ALLOYS
Charge transfer in intermetallics: $HfPt_3$, 15:813 (J;US)

PLESIOTHERAPY
See RADIOTHERAPY

PLUGS
See CLOSURES

PLUMES
Calibration of a groundwater flow and contaminant transport computer model: Progress toward model validation, 15:1302 (R;US)
Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)

PLUNGER METHOD
See CHARGE PLUNGER METHOD

PLUTONIUM
Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium, 15:919 (TG;US)
Multiple martensitic transformations, incommensurate/commensurate phases and charge-density-wave states in plutonium metal: Their consequences, 15:777 (R;US)
Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant, 15:127 (R;US)

PLUTONIUM 239
Development and testing program update for remote cell production of Pu 239, 15:1000 (R;US)
Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah, 15:1229 (R;US)

PLUTONIUM 239 TARGET
Determination of the areal density of the Pu-239 fission-foils, 15:968 (RA;DD)

PLUTONIUM 240
Leach versus fusion: Plutonium-239+240 analysis of soil samples from Hurricane, Utah, 15:1229 (R;US)

PLUTONIUM ALLOYS
Irradiation performance of metallic fuels, 15:392 (R;US)
[Research on actinides]: Foreign trip report, September 22, 1989–October 6, 1989, 15:790 (R;US)

PLUTONIUM FLUORIDES
Core-level binding energy shifts of the light actinide tetrafluorides and dioxides, 15:1693 (R;US)

PLUTONIUM NITRATES
Criticality experiments with mixed plutonium-uranium nitrate solution at plutonium fraction of 0.5, 0.4, and 0.2 in slab and cylindrical geometry, 15:1003 (J;US)
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)

PLUTONIUM OXIDES
A k_{eff} search and optimization using noisy differentials, 15:1005 (J;US)

PMMA
Harmonic generation with ultrashort pulses using nonlinear poled polymeric thin films, 15:912 (J;US)

PNA
See POLYCYCLIC AROMATIC HYDROCARBONS

PNEUMOCONIOSES
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)
Trends in coal-mine-dust exposures for longwall miners: 1981-1987, 15:28 (R;US)
POINT CONTACTS
See ELECTRIC CONTACTS
POISEUILLE FLOW
See LAMINAR FLOW
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POLAR REGIONS
See also ANTARCTIC REGIONS
Infrared and ionization structure of the polar mesosphere. Final report, 19 March 1985-15 May 1988, 15:1615 (R;US)
Ionospheric scintillation studies. Final report, October 1984-September 1987, 15:1616 (R;US)
Study of low-energy electrons over the polar region by using the USAF (United States Air Force) operational DMSP satellite. Final technical report, 15:1619 (R;US)
POLAR-CAP AURORAE
Relation between auroras observed below or at λ_{inv}=62 and polar coronal holes area, 15:1650 (RA;BR)
POLLUTANTS
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Selective pervaporation of organics from water, 15:938 (R;DE)
Workshop summary report: Water-quality criteria to protect wildlife resources. Report on pollutants considered to pose the greatest threat to wildlife when existing water-quality criteria are met, 15:1336 (R;US)
POLLUTION ABATEMENT
See also AIR POLLUTION ABATEMENT
S. 585: A bill Pollution Prevention Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 14, 1989, 15:1291 (B;US)
POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POLYATOMIC MOLECULES
Semiclassical theory of polyatomic infrared Multiphoton Processes, phase 1. Appendices A through C. Technical report (Final), 15:1695 (R;US)
POLYCYCLIC AROMATIC AMINES
Conformations of DNA modified by aromatic amines: Minimized semiempirical potential energy calculations and model building, 15:1375 (BA;US)
POLYCYCLIC AROMATIC HYDROCARBONS
Base sequence effects on interactions of aromatic mutagens with DNA [deoxyribonucleic acid]: Progress report, December 1, 1988–October 15, 1989, 15:1371 (R;US)
Thermodynamics and kinetics of complex organic systems: Progress report, March 15, 1989–March 14, 1990, 15:936 (R;US)
POLYETHYLENES
Extending the service life of 15KV polyethylene URD cable using silicone liquid, 15:307 (J;US)
Isotope driven critical scattering and phase separation in mixtures of deuterated and protonated polymers, 15:874 (R;US)
POLYMERS
See also ELASTOMERS
Depolymerization of a model coal polymer, 15:23 (J;US)
Flame retardant polymeric foams: Manufacturing, applications, and hazards. July 1984-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for July 1984-August 1989, 15:893 (R;US)
Interactions between two identical polymer chains studied with first-principles calculations, 15:956 (J;US)
Isotope driven critical scattering and phase separation in mixtures of deuterated and protonated polymers, 15:874 (R;US)
POLYMETHYLMETHACRYLATES
See PMMA
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYPEPTIDES
Directed mutagenesis indicates that the donor to P^{+}_{680} in photosystem II is tyrosine-161 of the D1 polypeptide, 15:1384 (J;US)
POLYSTYRENE
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
POLYTHENE
See POLYETHYLENES
POMERANCHUK PARTICLES
Confinement and the Pomeron, 15:1731 (R;US)
POMERONS
See POMERANCHUK PARTICLES
PONDS (COOLING)
See COOLING PONDS
POOL CRITICAL ASSEMBLY ORNL
See ORNL-PCA REACTOR
POPLARS
Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies, 15:1306 (J;US)
POROUS MATERIALS
Drying of permeable media: Whitaker's paradox explained, 15:1060 (BA;US)
Experiments with metallic and ceramic porous media. Report 30 December 1988, 15:988 (R;US)
POSITION (OPTICAL)
See COORDINATES
POSITION (RADIO)
See COORDINATES
POSITION SENSITIVE DETECTORS
Development of novel semiconductor detectors for the detection of ionizing radiation, 15:1171 (R;DE;In German)
Gradually evaporated foils for aberration correction of fission fragment time-of-flight in a direction-sensitive arrangement, 15:1196 (RA;DD)
[Atom probe field-ion microscopy research on silicon carbide whiskers and evaluate the position sensitive atom probe]: Foreign trip report, September 28, 1988–October 9, 1988, 15:1174 (R;US)
POSITRON BEAMS
A slow positron beam generator for lifetime studies, 15:222 (R;US)
POSITRON CAMERAS
First investigations with a stationary positron camera, 15:1405 (RA;DD)
POSITRON SOURCES
A slow positron beam generator for lifetime studies, 15:222 (R;US)
POSITRON-ELECTRON-PROTON STORAGE RING
See PEP STORAGE RINGS
POTABLE WATER
See DRINKING WATER
POTASSIUM IONS
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)
POTASSIUM OXIDES
Photoemission and inverse-photoemission studies of $Ba_{1-x}K_xBiO_{3-y}$, 15:854 (J;US)
Powder neutron diffraction study of the structural phase diagram of the $Ba_{1-x}K_xBiO_3$ system, 15:821 (R;US)
[Theoretical studies on the electronic structure of high-temperature superconductors], 15:1874 (R;US)
POTENTIAL (ELECTRIC)
See ELECTRIC POTENTIAL
POTENTIAL ENERGY
Recent advances in electronic structure theory and their influence on the accuracy of ab initio potential energy surfaces, 15:944 (R;US)
POWDERS
Micro-scale simulation of dynamic compaction of oxide and metal powder mixture, 15:837 (R;US)
Use of peat in wood adhesives, 15:16 (R;FI;In Finnish)
[Ceramic powder characterization]: Foreign trip report, October 7–14, 1988, 15:834 (R;US)

POWER DISTRIBUTION SYSTEMS
Adaptive protective relaying of transmission power systems for improved reliability, 15:332 (R;US)
Description of a simple fault locating device - the magnetic strip fault recorder, 15:324 (R;GB)
Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
POWER PLANTS
See also HYDROELECTRIC POWER PLANTS
THERMAL POWER PLANTS
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
POWER POOLS
See INTERCONNECTED POWER SYSTEMS
POWER SUBSTATIONS
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
POWER SUPPLIES
See also PHOTOVOLTAIC POWER SUPPLIES
SPACECRAFT POWER SUPPLIES
Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
Status of magnet power supply development for the APS [Advanced Photon Source] storage ring, 15:1144 (R;US)
POWER SYSTEMS
See also INTERCONNECTED POWER SYSTEMS
ABWR plant model for power-system operation, 15:320 (R;JP;In Japanese)
Condition monitoring of 132 kv bushings, 15:327 (R;GB)
Development of new evaluation method for distribution system reliability, 15:318 (R;JP;In Japanese)
Development of parallel algorithms for electrical power management in space applications, 15:330 (RA;US)
Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
Experimental study of long-term poor damping in power system. Experiments of parametric resonance at AC-DC power system simulator, 15:313 (R;JP;In Japanese)
Survey of adaptive control theory and its applications, 15:322 (R;JP;In Japanese)
POWER TRANSMISSION
See also LASER POWER TRANSMISSION
Evaluation method of supply cost and reliability for power system planning and operation. Introduction of evaluation indexes per spot and hour, 15:319 (R;JP;In Japanese)
POWER TRANSMISSION LINES
Charlie Creek–Belfield Transmission Line Project, North Dakota: Final Environmental Impact Statement, 15:1364 (R;US)
Federal electric power: Controversy relating to construction of transmission lines, 15:650 (R;US)
Method for estimating lightning outage rates of transmission lines, 15:316 (R;JP;In Japanese)
Model study of the effects of wind on ion current density and electric field at the ground level, 15:314 (R;JP;In Japanese)
Tracking harmonic notch filter, 15:333 (P;US)
POWER TRANSMISSION TOWERS
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
PRASEODYMIUM OXIDES
Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$, 15:851 (J;US)
Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds, 15:853 (J;US)
PRECOMPOUND-NUCLEUS EMISSION
Absence of parity effects in preequilibrium γ emission, 15:1800 (R;DE)
HOT - a Fortran program for calculation of fast nucleon emission from a hot zone, 15:1810 (RA;DD)
PEP (promptly emitted particles) - a Fortran program for calculation of fast nucleon emission in heavy-ion reactions, 15:1809 (RA;DD)
PREEQUILIBRIUM NUCLEAR PROCESSES
See PRECOMPOUND-NUCLEUS EMISSION
PRESSURE (1-760 TORR)
See LOW PRESSURE
PRESSURE (133 PA-0.1 MPA)
See LOW PRESSURE
PRESSURE VESSELS
Design assessment for metallic pressure vessels circumferentially reinforced with a pre-tensioned high-specific-strength anisotropic composite overwind, 15:979 (R;GB)
Design method for pressure vessels containing randomly flawed welds. Technical report, 15:992 (R;ZA)
Dosimetry-adjusted reactor physics parameters for pressure vessel neutron exposure assessment, 15:351 (J;US)
High pressure deuterium-tritium gas target vessels for muon-catalyzed fusion experiments, 15:1884 (R;US)
Stress-driven flow of impurities and its implications for embrittlement of structural components in nuclear applications, 15:453 (J;US)
Structural studies at high pressure using time-of-flight neutron powder diffraction, 15:1828 (R;US)
The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry, 15:352 (J;US)
Vacuum chamber thermal protection for the APS [Advanced Photon Source], 15:1109 (R;US)
PRESSURIZED WATER COOLED MODERATED REACTOR
See PWR TYPE REACTORS
PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS
PRESTRESSED CONCRETE
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
PRIMARY COOLANT CIRCUITS
A null-type instrument for on-line boron analysis, 15:364 (J;US)
PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report, 15:354 (R;DE;In German)
Tramp uranium, 15:542 (J;US)
PROCESS CONTROL
Application of neural networks for fault diagnosis in plant production, 15:1983 (R;US)
Using object-oriented development to support prototyping, 15:1998 (R;US)
PROCESSING
See also DATA PROCESSING
FOOD PROCESSING
IMAGE PROCESSING
REFINING
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)
PROCESSING (DATA)
See DATA PROCESSING
PRODUCTION (PLASMA)
See PLASMA PRODUCTION
PRODUCTION REACTORS
Use of the linear variate method of Monte Carlo for estimating uncertainty in thermal-hydraulic codes, 15:480 (R;US)
PROGRAM MANAGEMENT
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 9, Program evaluation, 15:682 (R;US)
PROGRAMMING LANGUAGES
See also PROLOG
Brief walk through KAOS (Kent Applicative Operating System), 15:1992 (R;GB)
PROJECT MANAGEMENT
See PROGRAM MANAGEMENT

PROJECTILES
Solving the blow-by problem in a two-stage gun, 15:996 (R;US)
PROLOG
An OPS5-english english-OPS5 parser and language generator, 15:2001 (BA;US)
PROMINENCES (SOLAR)
See SOLAR PROMINENCES
PROPAGATION (WAVE)
See WAVE PROPAGATION
PROPELLANTS
Gelled propellant flow: Boundary layer theory for power-law fluids in a converging planar channel, 15:1058 (R;US)
SRB combustion dynamics analysis computer program (CDA-2). Final report, 15:973 (R;US)
Using small scale tests to estimate the failure diameter of a propellant, 15:230 (R;US)
PROPERTIES (CHEMICAL)
See CHEMICAL PROPERTIES
PROPERTIES (MECHANICAL)
See MECHANICAL PROPERTIES
PROPERTIES (PHYSICAL)
See PHYSICAL PROPERTIES
PROPULSION
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)
Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989, 15:1887 (R;US)
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE COATINGS
Arcjet validation of surface catalycity using a viscous shock-layer approach, 15:755 (RA;FR)
Materials Division research and technology accomplishments for FY 87 and plans for FY 88, 15:782 (R;US)
Thrust chamber thermal barrier coating techniques, 15:758 (RA;US)
Vacuum plasma spray coating, 15:757 (RA;US)
Water-based anticorrosion coatings. February 1988-July 1989 (Citations from World Surface Coatings Abstracts). Report for February 1988-July 1989, 15:797 (R;US)
Water-based anticorrosion coatings. January 1980-January 1988 (Citations from World Surface Coatings Abstracts). Report for January 1980-January 1988, 15:796 (R;US)
PROTEINS
See also GELATIN
RHODOPSIN
Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)
In vivo stability and inertness of various direct labelled and chelate-tagged protein., 15:1401 (RA;AR)
Molecular biology of seed storage proteins and lectins, 15:1367 (B;US)
Mutagenesis - fundamental chemistry, 15:1374 (RA;US)
Non-muscle contractile proteins in the organ of corti, 15:1377 (J;US)
[Biological applications of synchrotron radiation]: Foreign trip report, August 13–19, 1989, 15:1427 (R;US)
PROTON REACTIONS
$0^+, T=0(p,p')0^-, T=1$ pion like excitations and nuclear response in the spin-isospin channel, 15:1825 (J;US)
Hydrogen interactions in PdH_n $(1 \leq n \leq 4)$, 15:867 (J;US)
Mass and transverse momentum dependence of the dielectron yield in *p*-Be collisions at 4.9 GeV, 15:1787 (J;US)
New measurement of the production polarization and magnetic moment of the Ξ^- hyperon, 15:1728 (J;US)
Relations between polarized-proton-nucleus and unpolarized-transverse-electron-nucleus scattering and applications, 15:1817 (J;US)
PROTON TRANSPORT
Transport data libraries for incident proton and neutron energies to 100 MeV, 15:1776 (R;US)
PROTON-ANTIPROTON INTERACTIONS
Semihard QCD and high-energy *pp* and $\bar{p}p$ scattering, 15:1750 (J;US)
PROTON-NEUTRON INTERACTIONS
Measurement of a mixed spin-spin correlation parameter for *np* elastic scattering, 15:1729 (J;US)
PROTON-PROTON INTERACTIONS
Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?, 15:1751 (J;US)
Semihard QCD and high-energy *pp* and $\bar{p}p$ scattering, 15:1750 (J;US)
PROTONS
Cone broadening in time-correlated associated-particle method fission cross-section measurements, 15:1782 (RA;DD)
High-rho$_T$ single photon and jet production at Fermilab energies, 15:1767 (BA;US)
Proton mean-free path in nuclear matter and in finite nuclei, 15:1824 (J;US)
PUBLIC LANDS
Proposed Resource Management Plan Amendment/Final Environmental Impact Statement for McGregor Range, 15:1365 (R;US)
PUBLIC UTILITIES
See also ELECTRIC UTILITIES
Why issues emerge: Final report, 15:592 (R;US)
PUGET SOUND
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report, 15:612 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report, 15:613 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report, 15:614 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report, 15:615 (R;US)
Briefing report to the EPA (Environmental Protection Agency) Science Advisory Board: The apparent effects threshold approach. Briefing report (Final), 15:1335 (R;US)
PULMONARY CANCER
See CARCINOMAS
PULPS
See SLURRIES
PULSE COLUMNS
See EXTRACTION COLUMNS
PULVERIZED FUEL ASH
See FLY ASH
PUMPS
Gasoline marketing: States' programs for pump labeling of gasoline ingredients, 15:66 (R;US)
Reactor coolant seal testing under station blackout conditions, 15:529 (J;US)
PUREX PROCESS
Analysis of samples from the Purex vessel vent silver reactor, 15:134 (R;US)
Calculation of concentration profiles and their experimental verification with a pulsed sieve-plate column and the reactive material system of uranyl nitrate, nitric acid/tributyl phosphate, kerosine, 15:122 (R;DE;In German)
Some observations concerning the chemistry of the Purex vessel vent silver reactor, 15:135 (R;US)
PURITY
See IMPURITIES
PWR TYPE REACTORS
See also ARDENNES B-1 REACTOR
BW STANDARD REACTOR
CE STANDARD REACTOR
DIABLO CANYON-1 REACTOR
DIABLO CANYON-2 REACTOR
GINNA-1 REACTOR
MIDLAND-1 REACTOR
MIDLAND-2 REACTOR

MIHAMA-1 REACTOR
MILLSTONE-2 REACTOR
OCONEE-1 REACTOR
OCONEE-2 REACTOR
OCONEE-3 REACTOR
SALEM-1 REACTOR
SALEM-2 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
SHIPPINGPORT REACTOR
SUMMER-1 REACTOR
SURRY-1 REACTOR
SURRY-2 REACTOR
SURRY-3 REACTOR
SURRY-4 REACTOR
THREE MILE ISLAND-2 REACTOR
WESTINGHOUSE STANDARD REACTOR
ZION-1 REACTOR
ZION-2 REACTOR
Experimental results pertaining to the performance of thermal igniters, 15:355 (R;US)

Capitalized Cost
Economic potential for future water reactors, 15:350 (J;US)

Containment
Study of hydrogen mixing within the Combustion Engineering System 80+ containment, 15:489 (R;US)

Expert Systems
An expert system for PWR core operation management, 15:467 (J;US)

Fuel Management
Mutual incidences of reactor operation and strategies for core refueling, 15:349 (J;US)
Operating plant scorecard: A statistical analysis of plant outage performance, 15:348 (J;US)
The influence of fuel cycle duration on nuclear unit performance, 15:347 (J;US)

Fuel Rods
Advanced nuclear fuels corporation's achievements with gadolinia integral burnable absorbers, 15:343 (J;US)
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)

Load Management
A knowledge-based system for control of xenon-induced spatial power oscillations during load-follow operations, 15:468 (J;US)

Loss Of Coolant
Multiloop integral system test (MIST): Test Group 31, SBLOCA [small-break loss-of-coolant accident] with varied boundary conditions: Final report: Volume 3, 15:497 (R;US)
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Optimization
Economic goals for the ALWR and sensitivity to cost parameters, 15:381 (J;US)
Introduction of advanced pressurized water reactors in France, 15:368 (J;US)

Pressure Vessels
Dosimetry-adjusted reactor physics parameters for pressure vessel neutron exposure assessment, 15:351 (J;US)
The LEPRICON code system: Consolidation of transport analytical and unfolding procedures in LWR pressure vessel dosimetry, 15:352 (J;US)

Primary Coolant Circuits
A null-type instrument for on-line boron analysis, 15:364 (J;US)
PKL-tests, test series IIB (end of blowdown). Vol. 2. Instrumentation and data acquisition. Final report, 15:354 (R;DE;In German)
Tramp uranium, 15:542 (J;US)

Radiation Protection
Fluence-to-dose conversion factor standards, 15:540 (J;US)

Reactor Accidents
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)

Reactor Cooling Systems
Flow-assisted corrosion-consequences for piping, 15:378 (J;US)
Improved reactor coolant system overpressure protection using pilot-operated safety, 15:377 (J;US)

Reactor Kinetics
Applications of parallel computer architectures to the real-time simulation of nuclear power systems, 15:358 (J;US)

Reactor Maintenance
Leak suppression at steam generator man-, hand-, and eyeholes, 15:370 (J;US)

Reactor Physics
LEOPARD on a personal computer, 15:341 (J;US)

Reactor Protection Systems
Automatic reactor protection system tester, 15:374 (J;US)

Reactor Safety
Analysis of loss-of-feedwater transients in MB-2 using RELAP5/MOD2, 15:513 (J;US)
Considerations for severe-accident management strategies in a pressurized water reactor, 15:521 (J;US)
Depressurization to mitigate direct containment heating, 15:522 (J;US)
Identification of the operating crew's information needs for accident management, 15:511 (J;US)
LWR fuel rod bundle behavior under severe fuel damage conditions, 15:533 (J;US)
Passive containment cooling for an advanced PWR, 15:373 (J;US)
Reactor coolant seal testing under station blackout conditions, 15:529 (J;US)
Signal validation using simultaneous consistency checking of multivariable measurements, 15:518 (J;US)
Technical support for the hydrogen control requirement for the EPRI advanced light water reactor requirements document, 15:523 (J;US)

Scale Models
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)

Service Life
Operational data collection and analysis for nuclear plant life extension, 15:339 (R;US)

Spent Fuel Elements
Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions, 15:183 (J;US)

Spent Fuel Storage
Analysis of a hypothetical criticality excursion during misloading of a high-capacity spent-fuel cask, 15:1008 (J;US)
Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)

Spent Fuels
Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code, 15:208 (J;US)
LWR spent-fuel radiochemical measurements and comparison with ORIGEN2 predictions, 15:184 (J;US)
Microstructural examination of oxidized spent PWR fuel by transmission electron microscopy, 15:375 (J;NL)
Status of spent-fuel transportation system development, 15:131 (J;US)
Studies on the back end of the nuclear fuel cycle, 15:413 (J;US)
The contribution of spent-fuel shipping cask residual contamination to the transportation source term, 15:130 (J;US)

Standardization
Capital costs for future light water reactors with modularization/standardization, 15:380 (J;US)
Modular construction approach for advanced nuclear plants, 15:372 (J;US)

Steam Generators
Nickel electroplating of steam generator tubes (kiss sleeving process), 15:376 (J;US)

Thermodynamics
An expert system design incorporating fuzzy logic for diagnosing heat imbalances in a nuclear power plant, 15:509 (BA;US)

Water Hammer
Avoiding steam-bubble-collapse-induced water hammers in piping systems, 15:336 (R;US)

PWR/241 TYPE REACTORS
See BW STANDARD REACTOR

PWR/41 TYPE REACTORS
See WESTINGHOUSE STANDARD REACTOR
PWR/80 TYPE REACTORS
See CE STANDARD REACTOR
PYROELECTRIC EFFECT
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)
PYROMETERS
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)
PYROTECHNIC DEVICES
Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB), 15:1223 (R;US)

Q

QUALITY ASSURANCE
The Eastern Environmental Radiation Facility's participation in interlaboratory and intralaboratory comparisons of environmental sample analyses, 1981–1986, 15:1840 (R;US)
QUALITY CONTROL
Preparation and quality control of fibrinogen ^{99m}Tc, 15:966 (RA;AR;In Spanish)
QUANTUM CHROMODYNAMICS
QCD minijet cross sections, 15:1771 (J;US)
Testing QCD with milli-TeV electrons, 15:1742 (J;NL)
QUANTUM FIELD THEORY
See also LATTICE FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM GRAVITY
Closed string field theory from polyhedra, 15:1768 (J;US)
Comment on "Canonical quantum field theory with exotic statistics", 15:1770 (J;US)
QUANTUM GRAVITY
The topology of moduli space and quantum field theory, 15:1769 (J;NL)
QUANTUM MECHANICS
Behavior of a quantum particle in contact with a classical heat bath, 15:1856 (J;US)
On a validity of adiabatic approach to the tunneling phenomena, 15:1879 (R;DE)
QUARK-ANTIQUARK INTERACTIONS
High-rho$_T$ single photon and jet production at Fermilab energies, 15:1767 (BA;US)
QUARKS
24×12^3 vs 16×8^3 lattices: Controlling finite-size effects in lattice SU(2) including fermions, 15:1772 (J;US)
Hierarchical chiral symmetry breaking and quark mass matrices revisited, 15:1743 (J;DE)
New-quark and -lepton production at high-energy e^+e^- colliders, 15:1749 (J;US)
Phenomenology of heavy quark production, 15:1732 (R;US)
Possible method in some extensions of the standard model to produce and detect Higgs bosons at hadron colliders, 15:1745 (J;US)
Radiative quark and lepton masses in a left-right gauge model, 15:1746 (J;US)
Renormalization-group-improved unitarity bounds on the Higgs-boson and top-quark masses, 15:1759 (J;US)
QUARTZ
Cathodoluminescence of shocked quartz at the Cretaceous-Tertiary boundary, 15:1511 (RA;US)
Iridium, shocked minerals, and trace elements across the Cretaceous/Tertiary boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic Ocean, 15:1490 (RA;US)
Respirable quartz exposure at silica flour producers, 1975-1986, 15:1269 (R;US)
QUINONES
Laser flash photolysis as a probe of redox protein-membrane interactions: Effect of binding of spinach plastocyanin and horse cytochrome c to lipid bilayer vesicles on the kinetics of reduction by flavin semiquinone, 15:1379 (J;US)

R

RADIATION ACCIDENTS
Safety team assessments at NRC [Nuclear Regulatory Commission]-licensed fuel facilities, 15:209 (J;US)
The continuing evolution of the Federal Radiological Emergency Response Plan, 15:1422 (R;US)
Utilization of dose assessment models to facilitate off-site recovery operations for accidents at nuclear facilities, 15:504 (R;US)
RADIATION BURDEN
See RADIATION DOSES
RADIATION DECONTAMINATION
See DECONTAMINATION
RADIATION DETECTION
See also COSMIC RAY DETECTION
NEUTRINO DETECTION
Image reconstruction for a radiation-field mapping system, 15:544 (J;US)
RADIATION DETECTORS
See also IONIZATION CHAMBERS
NEUTRON DETECTORS
POSITION SENSITIVE DETECTORS
SCINTILLATION COUNTERS
SEMICONDUCTOR DETECTORS
SHOWER COUNTERS
SUPERCONDUCTING COLLOID DETECTORS
TRANSITION RADIATION DETECTORS
Double grid avalanche counter with large dynamic range, 15:1185 (RA;DD)
Fast discriminator with low-level threshold, 15:1198 (RA;DD)
Optimal sensor configuration and survivable processing with correlated noise. Final report, 15:1227 (R;US)
Optimization of the associated particle (AP) detection system used for time-correlated associated-particle method (TCAPM) fission cross-section measurements in the 4.5 and 8.5 MeV neutron energy range, 15:1190 (RA;DD)
Pyroelectric devices and materials. January 1975-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1989, 15:894 (R;US)
Timing with fast particle detectors, 15:1186 (RA;DD)
RADIATION DOSEMETERS
See DOSEMETERS
RADIATION DOSES
Anthropomorphic phantoms, 15:1842 (J;US)
Development of international exemption principles for recycle and reuse, 15:500 (R;US)
Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code, 15:208 (J;US)
Fluence-to-dose conversion factor standards, 15:540 (J;US)
The effect of gender and remainder on effective dose equivalent, 15:1843 (J;US)
RADIATION DOSIMETRY
See DOSIMETRY
RADIATION EXPOSURE (DOSES)
See RADIATION DOSES
RADIATION HYGIENE
See RADIATION PROTECTION
RADIATION PROTECTION
A comparison of TLD and Monte Carlo calculation for beta dosimetry, 15:1846 (J;US)
Anthropomorphic phantoms, 15:1842 (J;US)
Calibration of individual neutron monitors in terms of H_e and the new ICRU dose-equivalent quantities, 15:1845 (J;US)
FDA (Food and Drug Administration) Compliance Program Guidance Manual. Section 4. Medical and radiological devices. Irregular report, 15:1465 (R;US)

On the influence of the exposure model on organ doses, 15:1841 (J;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)
Review of activities of the national commitee on radiation protection, 15:1431 (R;US)
The effect of gender and remainder on effective dose equivalent, 15:1843 (J;US)

RADIATION SAFETY
See RADIATION PROTECTION

RADIATION SOURCES
See also SYNCHROTRON RADIATION SOURCES
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Development of international exemption principles for recycle and reuse, 15:500 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)
Organization of the topical meeting on short-wavelength coherent radiation: generation and applications (4th) held in North Falmouth, Massachusetts. Final report, 1 June 1988-1 March 1989, 15:1024 (R;US)

RADIATION TRANSPORT
See also CHARGED-PARTICLE TRANSPORT
NEUTRAL-PARTICLE TRANSPORT
Analytic solution of a five-direction radiation transport model, 15:1836 (J;US)
Discrete ordinates methods for radiation transport, 15:473 (R;US)

RADIATORS
High capacity demonstration of honeycomb panel heat pipes. Final technical report, 15:1052 (R;US)

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE EFFLUENTS
Upgrade of the radioactive air emission systems at Oak Ridge National Laboratory, 15:159 (RA;US)

RADIOACTIVE GASEOUS WASTES
See RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also RADIOACTIVE WASTES
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)

RADIOACTIVE PARTICULATES
See PARTICLES

RADIOACTIVE WASTE DISPOSAL
Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III, 15:150 (R;DE;In German)
Lead iron phosphate glass as a containment medium for disposal of high-level nuclear waste, 15:197 (P;US)
Oversight-a key ingredient in the HLW repository program, 15:186 (J;US)
Pyramiding tumuli waste disposal site and method of construction thereof, 15:198 (P;US)

RADIOACTIVE WASTE FACILITIES
See also WIPP
Economic analysis of projected high-level waste immobilization operations at the Savannah River Plant, 15:137 (RA;US)
Filtration of polydispersed colloids, 15:180 (B;US)
Pyramiding tumuli waste disposal site and method of construction thereof, 15:198 (P;US)
The April 1962 criticality event in the Recuplex facility, 15:174 (R;US)

RADIOACTIVE WASTE MANAGEMENT
Application of QA to R & D support of HLW programs, 15:195 (J;US)
Characteristics of spent fuel and high-level waste, 15:192 (J;US)
DOE policy: Waste management QA, 15:193 (J;US)
Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987, 15:49 (B;US)
NRC overview: Repository QA, 15:194 (J;US)
Safeguards and security recommendations for the OCRWM [Office of Civilian Radioactive Waste Management] Federal Waste Management System, 15:213 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)

RADIOACTIVE WASTE PROCESSING
A delayed-neutron monitor for a liquid-waste stream with high gamma-ray intensity, 15:151 (R;US)
Analysis of samples from the Purex vessel vent silver reactor, 15:134 (R;US)
Correlation between composition effects on glass durability and the structural role of the constituent oxides, 15:196 (J;US)
Distributed control system-based process simulation: Revision 1, 15:177 (R;US)
Hanford Waste Vitrification Plant remote handling application, 15:173 (R;US)
Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries, 15:199 (P;US)
Use of bioadsorbents for removing dissolved metals from dilute solutions, 15:181 (B;US)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Correlation between composition effects on glass durability and the structural role of the constituent oxides, 15:196 (J;US)
Effective sample labeling, 15:167 (R;US)
Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending June 30, 1989, 15:147 (R;US)
Neutron dieaway methods for criticality safety measurements of fissile waste, 15:153 (R;US)
Nuclear waste issues. Hearings before the Subcommittee on Energy and Power of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session on H.R. 2888 and H.R. 2967, June 11 and October 16, 1987, 15:182 (B;US)
The effect of liner hydraulic conductivity on disposal cell performance, 15:188 (J;US)

RADIOACTIVITY
Specific activity determination of ^{125}I labelled prolactin by receptor and radioinmunological self-displacement methods, 15:1399 (RA;AR)

RADIOAPPLICATORS
See RADIATION SOURCES

RADIOBIOLOGICAL EFFECTS
See BIOLOGICAL RADIATION EFFECTS

RADIOCARBON DATING
See CARBON 14
ISOTOPE DATING

RADIOCOLLOIDS
Filtration of polydispersed colloids, 15:180 (B;US)

RADIODIAGNOSIS (RADIONUCLIDES)
See NUCLEAR MEDICINE

RADIOECOLOGICAL CONCENTRATION
Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)

RADIOFREQUENCY SYSTEMS
See RF SYSTEMS

RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY
RADIOISOTOPE KINETICS
See RADIONUCLIDE KINETICS
RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION
RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS
RADIOISOTOPES
Identification of contaminants of concern in Hanford ground waters, 15:1341 (R;US)
RADIOLOGICAL PERSONNEL
Upgrading radiological work practices through employee participation, 15:365 (J;US)
RADIOLOGICAL PROTECTION
See RADIATION PROTECTION
RADIOLOGICAL WARFARE
Review of four years of literature (1985, 1986, 1987 and 1988) for the physiological and psychological effects of the nuclear/biological/chemical and extended operations on soldier-performance program. Final report, September 1988-January 1989, 15:1224 (R;US)
RADIOLOGY
See also BIOMEDICAL RADIOGRAPHY
RADIOTHERAPY
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)
FDA (Food and Drug Administration) Compliance Program Guidance Manual. Section 4. Medical and radiological devices. Irregular report, 15:1465 (R;US)
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
RADIONUCLIDE CONCENTRATION
See RADIOACTIVITY
RADIONUCLIDE DISTRIBUTIONS
See RADIONUCLIDE KINETICS
RADIONUCLIDE KINETICS
Biodistribution and dosimetric evaluation of ^{186}Re hydroxy ethylen diphosphate., 15:1432 (RA;AR;In Spanish)
RADIONUCLIDE METABOLISM
See RADIONUCLIDE KINETICS
RADIONUCLIDE MIGRATION
Documentation of SPECTROM-55: A finite element thermohydrogeological analysis program: Revision 0, 15:142 (R;US)
Hydrology and radionuclide migration at the Nevada Test Site, 15:171 (R;US)
Isotopic effects on solubility-limited mass transfer, 15:156 (R;US)
Preliminary interpretation of geophysical logs and in situ hydrologic properties in fractured limestone at Loring Air Force Base, 15:1296 (R;US)
Radioactive contamination and radionuclide migration in ground water. January 1970-May 1989 (Citations from the NTIS data base). Report for January 1970-May 1989, 15:1348 (R;US)
[Environmental transport of radionuclides]: Foreign trip report, September 14–26, 1989, 15:1285 (R;US)
RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
RADIONUCLIDE TRANSFER (IN ORGANISMS)
See RADIONUCLIDE KINETICS
RADIONUCLIDE TURNOVER
See RADIONUCLIDE KINETICS
RADIONUCLIDES
See RADIOISOTOPES
RADIOPHARMACEUTICALS
Preparation and quality control of ^{186}Re compounds., 15:964 (RA;AR;In Spanish)
Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986, 15:961 (R;AR)
Synthesis and biodistribution of some radioiodinated diamines, 15:1397 (RA;AR)
[The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989, 15:959 (R;US)
RADIOPRESERVATION
Alaskan Commodities Irradiation Project: An options analysis study, 15:1415 (R;US)
[Alaskan commodities irradiation project: An options analysis study]: Final technical report, 15:1414 (R;US)
RADIOSENSITIZERS
Synthesis and properties of 1-(4-iodo-5nitroimidazolyl)-2-hydroxy-3 methoxypropane. A novel radiosensitizer for use as an hypoxic cell marker, 15:963 (RA;AR)
RADIOSURGERY
See RADIOTHERAPY
RADIOTHERAPY
Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)
Multisegmented ionization chamber dosimetry system for flight ion beams, 15:1208 (J;NL)
RADIOWAVE RADIATION
See also LONG WAVE RADIATION
SOLAR RADIO BURSTS
Characteristics of electromagnetic wave forms with lightning in winter season, 15:1235 (R;JP;In Japanese)
Development in predictions of auroral radio wave absorption in the southern hemisphere, 15:1625 (RA;BR)
Geomagnetic storm effects on radiowave absorption in the geomagnetic anomaly region, 15:1670 (RA;BR)
Preliminary results of recent centimetre wavelength radio observation of Mercury, Venus, Mars, Jupiter and Saturn, 15:1558 (RA;BR)
RADIUM
Evaluating various adsorbents and membranes for removing radium from ground water, 15:1346 (R;US)
RADIUM 218
Comment on "Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei", 15:1795 (J;US)
Gai replies, 15:1796 (J;US)
RADIUM 222
Comment on "Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei", 15:1795 (J;US)
Gai replies, 15:1796 (J;US)
RADIUM 226
Concentrations of ^{226}Ra and ^{210}Pb in agricultural products surrounding the first brazilian mine and mill in Pocos de Caldas, MG, 15:200 (R;BR;In Portuguese)
Evaluation of the ^{226}Ra transport by rivers sediments surroundings the brazilian uraniums mining and milling, 15:201 (R;BR)
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060), 15:1311 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)
RADIUM D
See LEAD 210
RADON
Phosphate fertilizer industry survey, CF Chemicals, Inc., Bartow, Florida, May 17, 1976, 15:1411 (R;US)
RADON 222
Radon measurements in the Amazon region (GTE-ABLE2B, April-May, 1987), 15:1283 (RA;BR)

Radon-daughter grab-sampling technical exchange meeting, April 10–14, 1989, 15:684 (R;US)

RAIL TRANSPORT
Railroad accident report: Head-on collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with release of hazardous materials near Altoona, Iowa, on July 30, 1988. Irregular report, 15:697 (R;US)

RAMJET ENGINES
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)

RARE EARTHS
See also CERIUM
DYSPROSIUM
EUROPIUM
GADOLINIUM
LANTHANUM
SAMARIUM
TERBIUM
THULIUM
YTTERBIUM
Addition compounds between lanthanide trifluoromethane sulphonates and N,N,N',N' - tetrametilmalonamida (TMMA), 15:928 (R;BR;In Portuguese)

RATS
Sequential rat blood boron concentration measurements method using CR-39 SSNTDs, 15:1406 (J;US)

REACTIVITY
Inverse dynamics and the hybrid method of reactivity measurement, 15:438 (J;US)

REACTOR ACCIDENTS
See also ATWS
DESIGN BASIS ACCIDENTS
FUEL ELEMENT FAILURE
LOSS OF COOLANT
LOSS OF FLOW
MELTDOWN
REACTOR CORE DISRUPTION
Considerations for severe-accident management strategies in a pressurized water reactor, 15:521 (J;US)
Depressurization to mitigate direct containment heating, 15:522 (J;US)
Development of an accident management expert system for containment assessment, 15:508 (BA;US)
Economic consequences of the Chernobyl accident in Norway in 1986 and 1987, 15:535 (J;US)
Effectiveness of cleanup criteria relative to an accidental nuclear release, 15:527 (J;US)
Evaluation of the consequences of containment bypass scenarios, 15:532 (J;US)
Identification of the operating crew's information needs for accident management, 15:511 (J;US)
Iodine speciation and partitioning in PWR steam generator accidents: Final report, 15:356 (R;US)
The radiological impact of the Chernobyl accident, 15:524 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
Update and comparisons of dose estimates following the Chernobyl accident, 15:536 (J;US)
Validation of environmental models for the air-to-milk pathway for ^{131}I and the air-to-milk/beef/grain pathways for ^{137}Cs based on observations following the Chernobyl accident, 15:525 (J;US)

REACTOR COMPONENTS
See also BREEDING BLANKETS
FUEL ELEMENTS
REACTOR COOLING SYSTEMS
REACTOR CORES
A phenomenological model of the classical thermal creep curve, 15:394 (J;US)
Chemical decontamination of BWR fuel and core materials: Hot cell examination of BWR fuel: Final report, 15:337 (R;US)
Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C, 15:395 (J;US)
Near-wall fluid jet velocity profile measurements using laser speckle velocimetry, 15:456 (J;US)
Rotating machinery surveillance system reduces plant downtime and radiation exposure, 15:346 (J;US)
Stress-driven flow of impurities and its implications for embrittlement of structural components in nuclear applications, 15:453 (J;US)
The centralized reliability data organization (CREDO) assessment of critical component unavailability in liquid-metal reactors, 15:466 (J;US)

REACTOR CONTROL SYSTEMS
A knowledge-based system for control of xenon-induced spatial power oscillations during load-follow operations, 15:468 (J;US)
Introduction to digital instrumentation and control techniques used in nuclear engineering, 15:463 (J;US)
Utilization of simulation data for control system reliability analysis, 15:462 (J;US)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR COOLING SYSTEMS
See also PRIMARY COOLANT CIRCUITS
A new balance-of-plant model for the SASSYS-1 LMR systems analysis code, 15:391 (R;US)
ANSPipe: An IBM-PC interactive code for pipe-break assessment, 15:515 (J;US)
An experimental study of two-phase natural circulation in an adiabatic flow loop, 15:428 (BA;US)
An improved steam generator model for the SASSYS code, 15:393 (R;US)
Application of an industrial gas supply system to a hydrogen water chemistry installation, 15:353 (J;US)
Depressurization to mitigate direct containment heating, 15:522 (J;US)
Development and application of a new material for control of asiatic clams, 15:410 (J;US)
Flow-assisted corrosion-consequences for piping, 15:378 (J;US)
Improved reactor coolant system overpressure protection using pilot-operated safety, 15:377 (J;US)
Pilot RCM application to the Diablo Canyon main stream system, 15:371 (J;US)
Reactor coolant seal testing under station blackout conditions, 15:529 (J;US)

REACTOR CORE DISRUPTION
Considerations for severe-accident management strategies in a pressurized water reactor, 15:521 (J;US)
LWR fuel rod bundle behavior under severe fuel damage conditions, 15:533 (J;US)

REACTOR CORES
GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor, 15:479 (J;US)
Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)
Investigation of high-temperature materials for uranium-fluoride-based gas core reactor systems, 15:437 (J;US)
Use of Axially zoned gadolinia in GE [General Electric Co.] BWR reload fuel, 15:342 (J;US)

REACTOR DECOMMISSIONING
Development of international exemption principles for recycle and reuse, 15:500 (R;US)
Records important for decommissioning of nuclear reactors, 15:502 (R;US)
Technology, safety and costs of decommissioning reference non-fuel-cycle nuclear facilities: Compendium of current information, 15:495 (R;US)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELING
Mutual incidences of reactor operation and strategies for core refueling, 15:349 (J;US)
Operating plant scorecard: A statistical analysis of plant outage performance, 15:348 (J;US)
The influence of fuel cycle duration on nuclear unit performance, 15:347 (J;US)

REACTOR FUELS
See NUCLEAR FUELS

REACTOR INSTRUMENTATION
Introduction to digital instrumentation and control techniques used in nuclear engineering, 15:463 (J;US)

REACTOR KINETICS
Acceleration of energy iterations in thermal-hydraulic calculations, 15:449 (J;US)
Application of PCs to a nuclear reactor laboratory course, 15:431 (J;US)
Applications of parallel computer architectures to the real-time simulation of nuclear power systems, 15:358 (J;US)
Assessment of the nearly implicit solution scheme of RELAP5/MOD2: Numerical viscosity and suppression of oscillations, 15:450 (J;US)
Development and experimental demonstration of a noise-reduction technique for a nonlinear dynamic system, 15:464 (J;US)
Dynamic analysis of heated channels with time-dependent inlet temperature, heat flux, and pressure drop, 15:448 (J;US)
Numerical methods: Analytical benchmarking in transport theory, 15:432 (J;US)
Reactivity calculations of the Chernobyl accident, 15:530 (J;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:457 (R;US)
Transient analysis method for two-dimensional discharge flow using a two-fluid model, 15:451 (J;US)

REACTOR KINETICS EQUATIONS
Utilization of ADE method in the numerical resolution of the neutron Kinetic equation, 15:424 (R;BR;In Portuguese)

REACTOR MAINTENANCE
A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)
Experience-based classical RCM at Ginna, 15:367 (J;US)
Optimal preventive maintenance of a nuclear plant subsystem using dynamic programming, 15:411 (J;US)
Optimizing preventive maintenance, 15:418 (J;US)
Pilot RCM application to the Diablo Canyon main stream system, 15:371 (J;US)
Rotating machinery surveillance system reduces plant downtime and radiation exposure, 15:346 (J;US)

REACTOR MATERIALS
See also NUCLEAR FUELS
Investigation of high-temperature materials for uranium-fluoride-based gas core reactor systems, 15:437 (J;US)
[Gas-cooled reactor materials]: Foreign trip report, June 11–16, 1988, 15:382 (R;US)
[High temperature metallic materials for gas-cooled reactors]: Foreign trip report, June 17–25, 1988, 15:383 (R;US)
[Structural design criteria for HTGR reactors]: Foreign trip report, January 29, 1989–February 3, 1989, 15:384 (R;US)

REACTOR MONITORING SYSTEMS
A nuclear reactor alarm display system utilizing AI techniques for alarm filtering, 15:459 (BA;US)
An expert system design incorporating fuzzy logic for diagnosing heat imbalances in a nuclear power plant, 15:509 (BA;US)
Development of an expert system for signal validation, 15:420 (J;US)
Exabyte helical scan devices at Fermilab, 15:1136 (J;US)
Signal validation using simultaneous consistency checking of multivariable measurements, 15:518 (J;US)

REACTOR OPERATION
See also REACTOR START-UP
Achieving excellence on shift through teamwork, 15:417 (J;US)
Operating plant scorecard: A statistical analysis of plant outage performance, 15:348 (J;US)
Research activities in the field of human factors: Evaluation and prospects, 15:415 (J;US)
True-personality-assisted self-awareness expert system, 15:416 (J;US)
Turning point in the study of human factors: From centurion to modern man, 15:414 (J;US)

REACTOR OPERATORS
Achieving excellence on shift through teamwork, 15:417 (J;US)
An instructional hydraulic analog of fission product poisoning dynamics, 15:430 (J;US)
Reactor operator: Training for the job while earning college credit, 15:404 (J;US)

REACTOR PHYSICS
A hybrid Monte Carlo method, 15:447 (J;US)
An instructional hydraulic analog of fission product poisoning dynamics, 15:430 (J;US)
Computational geometry for reactor applications, 15:444 (J;US)
Does a point lie inside a polygon, 15:446 (J;US)
Forward versus backward Kolmogorov equations with feedback, 15:442 (J;US)
Inverse dynamics and the hybrid method of reactivity measurement, 15:438 (J;US)
LEOPARD on a personal computer, 15:341 (J;US)
Numerical solution of the two-dimensional space-time diffusion equations, 15:443 (J;US)
Perturbation, PCs, and the undergraduate, 15:406 (J;US)
SABRINA - an interactive geometry modeler for MCNP, 15:445 (J;US)
Synthetic acceleration of integral-transport scattering iterations, 15:441 (J;US)
Synthetic acceleration of one-group S_N k-eigenvalue problems, 15:440 (J;US)

REACTOR PROTECTION SYSTEMS
Automatic reactor protection system tester, 15:374 (J;US)

REACTOR SAFETY
Identification of the operating crew's information needs for accident management, 15:511 (J;US)
Implications of the Chernobyl accident for US reactors, 15:526 (J;US)
Maanshan small-LOCA analysis, 15:537 (J;US)
NRC regulatory information conference: Proceedings, 15:493 (R;US)
Transactions of the seventeenth water reactor safety information meeting, 15:494 (R;US)
[Development of risk-based safety indicators]: Foreign trip report, July 1, 1989–July 9, 1989, 15:486 (R;US)

REACTOR SIMULATORS
A computerized experiment for comparison between methods of uncertainty propagation, 15:461 (BA;US)
Horizontal cold source: Experimental cooling tests of the horizontal cold source cell with nitrogen gas, 15:427 (TG;US)

REACTOR START-UP
An expert system for PWR core operation management, 15:467 (J;US)

REACTORS
See also LIQUID METAL COOLED REACTORS
PRODUCTION REACTORS
WATER COOLED REACTORS
Standard format and content for decommissioning plans for nuclear reactors, 15:501 (R;US)

REAL TIME SYSTEMS
Distribution of processing tasks for the REMIDS II real-time processor system. Technical report, 15:1980 (R;US)

RECEIVERS (SOLAR)
See SOLAR RECEIVERS

RECHARGE
Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)

RECOIL DISTANCE METHOD
See CHARGE PLUNGER METHOD

RECYCLING
Economical disposal of municipal solid waste with minimal discharges to the atmosphere and maximum recycling of energy and metal values, 15:731 (R;US)
Recycling grants in Illinois: A two year review. Final report, 15:717 (R;US)

RECYCLING (FUEL)
See REPROCESSING

REFINING
Centrifuges: fuel technology applications. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:12 (R;US)

REFLECTIVITY
A program for calculating and plotting soft x-ray optical interaction coefficients for molecules, 15:1215 (R;US)

REFRIGERANTS
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
Vapor pressures and gas-phase PVT data for 1,1,1,2-tetrafluoroethane, 15:950 (J;US)
REFRIGERATORS
Cryocooler for high-acceleration applications. Quarterly report No. 3, 15 March-14 June 1989, 15:984 (R;US)
REFUSE
See SOLID WASTES
REGENERATIVE FUEL CELLS
'Hytec' - New concept for a thermally regenerative electrochemical cell, 15:670 (BA;US)
Corrosion testing of candidates for the alkaline fuel cell cathode, 15:665 (RA;US)
Non-noble electrocatalysts for alkaline fuel cells, 15:664 (RA;US)
Oxygen electrodes for rechargeable alkaline fuel cells, 15:663 (RA;US)
REGULATORY GUIDES
Regulating the disposal of low-level radioactive waste: A guide to the Nuclear Regulatory Commission's 10 CFR part 61, 15:158 (R;US)
REINFORCED CONCRETE
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
REINFORCED MATERIALS
See also REINFORCED CONCRETE
Thermodynamic analysis of chemical compatibility of several reinforcement materials with niobium aluminides. Final contractor report, 15:881 (R;US)
RELIEF VALVES
Acoustic monitoring of BWR main steam safety relief valves, 15:546 (J;US)
REM
See DOSE EQUIVALENTS
REMOTE HANDLING EQUIPMENT
Tritium contamination studies involving test materials and jet remote handling tools, 15:1962 (R;US)
REPROCESSING
See also PUREX PROCESS
THOREX PROCESS
Studies on the back end of the nuclear fuel cycle, 15:413 (J;US)
RESEARCH PROGRAMS
See also COORDINATED RESEARCH PROGRAMS
Application of QA to R & D support of HLW programs, 15:195 (J;US)
Environmental and climate research programme 1988/89, 15:1236 (R;DE;In German)
RESEARCH REACTORS
See also BSR-1 REACTOR
BSR-2 REACTOR
FFTF REACTOR
GRENOBLE REACTOR
HFIR REACTOR
MITR REACTOR
NBSR REACTOR
Conversion and standardization of US university reactor fuels using LEU, status 1989, 15:475 (R;US)
Discharge of ^{41}Ar from a neutron activation analysis facility, 15:545 (J;US)
GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor, 15:479 (J;US)
RESERVOIR ROCK
Characterization of oil and gas reservoir heterogeneity: Second quarterly report, July 15–October 15, 1989, 15:47 (R;US)
Reservoir characterization for the CO_2 enhanced oil recovery process: Final report, 15:52 (R;US)
Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)
The incorporation of the effects of CO_2 solubility in brine into a compositional simulator, 15:57 (B;US)
RESID
See PETROLEUM RESIDUES
RESIDENCES
See HOUSES
RESIDENTIAL BUILDINGS
See also HOUSES
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 2, Multifamily building technologies, 15:678 (R;US)
Energy conservation technical information guide: Volume 3, Residential buildings, 15:693 (R;US)
Energy efficiency in the housing stock, 15:675 (R;GB)
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
RESIDENTIAL SECTOR
An integrated, long-term economic, energy-market and emissions policy model, 15:1255 (R;US)
Natural gas annual 1988: Volume 1, 15:91 (R;US)
Residential end-use energy consumption: A survey of conditional demand estimates: Final report, 15:652 (R;US)
RESIDUAL OILS
See PETROLEUM RESIDUES
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESISTAL
See COPPER BASE ALLOYS
RESISTIVITY (ELECTRIC)
See ELECTRIC CONDUCTIVITY
RESONANCE
$^{89}Y+n$ resonances for E=10-740 keV and intermediate structure, 15:1790 (J;NL)
RESONATORS
Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)
RESOURCE CONSERVATION
Mt. Trumbull and Mt. Logan wilderness management plan. Draft report, 15:623 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Pesticide application, 15:722 (R;US)
RESOURCE RECOVERY ACTS
Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems, 15:80 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
RESPIRABLE DUSTS
See DUSTS
RESPIRATORY SYSTEM DISEASES
See also PNEUMOCONIOSES
Responses of susceptible subpopulations to nitrogen dioxide. Research report, June 1983-January 1988, 15:1461 (R;US)
RETROFITTING
Generic cost estimates for retrofit activities at nuclear power plants, 15:421 (J;US)
REVERSE-FIELD PINCH
CFRX, a one-and-a-quarter-dimensional transport code for field-reversed configuration studies, 15:1911 (J;NL)
CPRF/ZTH front-end torus design and fabrication status, 15:1947 (R;US)
Confinement Physics Research Facility/ZTH: A progress report, 15:1956 (R;US)
Design and construction status of the energy system for the ZTH experiment, 15:1960 (R;US)
Design and drafting document control procedures for CPRF/ZTH experiment, 15:1946 (R;US)
The design of the CPRF [Confinement Physics Research Facility] control system, 15:1957 (R;US)
Theoretical reversed field pinch studies: Annual progress report, October 31, 1988–November 1, 1989, 15:1891 (R;US)
Thermal analysis of the CPFR [Confinement Physics Research Facility]/ZTH apparatus, 15:1944 (R;US)
RF SYSTEMS
Applications of neutral beam and RF technologies, 15:1973 (J;US)
Status of RF superconductivity at Argonne, 15:1115 (R;US)

RHENIUM 186
Preparation and quality control of ^{186}Re compounds., 15:964 (RA;AR;In Spanish)
RHENIUM 190
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
RHENIUM COMPLEXES
[The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989, 15:959 (R;US)
RHENIUM SILICIDES
Narrow bandgap semiconducting silicides: Intrinsic infrared detectors on a silicon chip. Final report, 15:883 (R;US)
RHODIUM 100
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)
RHODOPSIN
Deprotonation of lipid-depleted bacteriorhodopsin, 15:1383 (J;US)
RICHLAND FFTF REACTOR
See FFTF REACTOR
RICHLAND NPR REACTOR
See N-REACTOR
RIEMANN WAVES
See SHOCK WAVES
RINGS
Method of using a ferromagnet material having a high permeability and saturation magnetization at low temperatures, 15:1017 (P;US)
RINGS (STORAGE)
See STORAGE RINGS
RISER CRACKING
See COAL LIQUEFACTION
RISK ANALYSIS
See RISK ASSESSMENT
RISK ASSESSMENT
Elicitation of natural language representations of uncertainty using computer technology, 15:1987 (R;US)
Environmental boundaries to energy development, 15:616 (R;US)
Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)
Pharmacokinetics in risk assessment: drinking water and health. Volume 8, 15:1445 (R;US)
RIVERS
Evaluation of the ^{226}Ra transport by rivers sediments surroundings the brazilian uraniums mining and milling, 15:201 (R;BR)
Solar activity and EL Nino: the auroral connection, 15:1681 (RA;BR)
Solar activity and EL nino, 15:1562 (RA;BR)
Solar wind streams, magnetospheric substorms and El Nino, 15:1564 (RA;BR)
ROBERT E. GINNA-1 REACTOR
See GINNA-1 REACTOR
ROBOTS
Inspection of contaminated hot cell ductwork, 15:991 (R;US)
[French technological progress in the field of robotics and teleoperation]: Foreign trip report, September 9,1989–September 30, 1989, 15:1991 (R;US)
ROCK MECHANICS
UDEC (Universal Distinct Element Code) Version ICG1.5: Software summary, 15:161 (R;US)
ROCK SALT
See SALT DEPOSITS
ROCKET ENGINES
Application of Advanced Material for Turbomachinery and Rocket Propulsion, 15:756 (R;US)
ROCKS
See also SEDIMENTARY ROCKS
Age of the rocks and the metamorphic episodes from the Southeastern of Sao Paulo state, 15:1469 (R;BR;In Portuguese)
Geochronological data for lithostratigraphic complexes of a crystalline basement from the South regions of Minas Gerais and adjacent areas of the Sao Paulo state, 15:1471 (R;BR;In Portuguese)
Intraval-project test case 5: tracer tests at Finnsjoen. Predictive modelling of the radially converging experiment, 15:179 (R;FI)
K-Ar geochronology of mafic dyke swarms from the meridional part of Sao Francisco craton and implications on tectonic context, 15:1470 (R;BR;In Portuguese)
Lead-lead dating of migmatitic rocks from the region of the Sao Jose dos Campos, Sao Paulo state, Brazil, 15:1472 (R;BR)
ROCKY FLATS PLANT
Nuclear materials: Additional information on shipments from DOE's Rocky Flats plant, 15:127 (R;US)
RODS (FUEL)
See FUEL RODS
ROENTGEN EQUIVALENT MAN
See DOSE EQUIVALENTS
ROLPHTON NPD-2 REACTOR
See NPD REACTOR
ROOFS
Thermal performance of lightweight inverted warm deck flat roofs, 15:674 (R;GB)
ROUGH VACUUM
See LOW PRESSURE
RUBBER INDUSTRY
Survey for N-nitroso compounds at Industrial Products Plant, Goodyear Tire and Rubber Company, Akron, Ohio. March 30, 1978, 15:1272 (R;US)
RUPTURE DISKS
See RELIEF VALVES
RUPTURES
ANSPipe: An IBM-PC interactive code for pipe-break assessment, 15:515 (J;US)
RURAL AREAS
United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)
RURAL ELECTRIFICATION ADMINISTRATION
See US REA
RUTHENIUM COMPOUNDS
See also RUTHENIUM SILICIDES
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
RUTHENIUM SILICIDES
$CeRu_2Si_2$ and URu_2Si_2: Same or different?, 15:870 (R;US)
RUTILE
Crystal defects and the dissolution kinetics of rutile, 15:1546 (J;US)
RYDBERG STATES
Angular momentum distributions of autoionizing states produced in 1.5 MeV $C^{q+} + C_{foil}$ and C^{q+} + He collisions, 15:1785 (R;FR)

S

S CODES
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)
SAFEGUARDS
See also IAEA SAFEGUARDS
Evaluating the contributions of material control to insider protection, 15:217 (R;US)
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SAFETY VALVES
See RELIEF VALVES
SALEM NUCLEAR GENERATING STATION UNIT-1
See SALEM-1 REACTOR
SALEM NUCLEAR GENERATING STATION UNIT-2
See SALEM-2 REACTOR

SALEM-1 REACTOR
A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)
SALEM-2 REACTOR
A comprehensive approach to RCM-based preventive maintenance program development, 15:531 (J;US)
SALINE ZONE
See OIL SHALES
SALT DEPOSITS
Experimental studies of the migration of radionuclides of the elements Cs, Sr, Ra, Mo, I, and C in the caprock of the Gorleben candidate repository. Project programme III, 15:150 (R;DE;In German)
SALT TALKS
Force structure implications of START. Study project, 15:749 (R;US)
SAMARIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
SAMARIUM COMPLEXES
Kinetics of samarium solvent extraction and stripping in systems with DiOMPh, 15:941 (RA;SU;In Russian)
SAMARIUM OXIDES
Bulk superconductivity above 30 K in T^*-phase compounds, 15:861 (J;US)
SANITARY LANDFILLS
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)
Ground-water monitoring compliance plan for the Hanford Site Solid Waste Landfill, 15:1303 (R;US)
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)
SAVANNAH RIVER PLANT
Applications of probabilistic risk assessment to criticality safety at the Savannah River Site, 15:507 (R;US)
Benzene/nitrous oxide flammability in the precipitate hydrolysis process, 15:121 (R;US)
Development and testing program update for remote cell production of Pu 239, 15:1000 (R;US)
The human factor in first-year operations, 15:116 (J;US)
SAVANNAH RIVER PLANT L REACTOR
See L REACTOR
SAVANNAH RIVER PLANT P REACTOR
See P REACTOR
SCALE MODELS
Multiloop integral system test (MIST): Test Group 33, HPI-PORV cooling: Final report, Volume 5, 15:498 (R;US)
SCANDIUM
On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)
SCATTERING
Hypercube matrix computation task. Report, 1986-1988, 15:1830 (R;US)
Routes to chaotic scattering, 15:1744 (J;US)
SCHNELLER NATRIUMGEKUEHLTER REAKTOR
See SNR REACTOR
SCHOOL BUILDINGS
Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)
SCHOOL FACILITIES
See EDUCATIONAL FACILITIES
SCHOOL PLANT
See EDUCATIONAL FACILITIES
SCHOOLS
See EDUCATIONAL FACILITIES
SCINTILLATION CHAMBERS
See SCINTILLATION COUNTERS
SCINTILLATION COUNTERS
See also GAS SCINTILLATION DETECTORS
LIQUID SCINTILLATION DETECTORS
Cryogenic detectors for particle physics, 15:1168 (R;FR)
Investigation of scintillation materials, 15:1177 (RA;DD)
SCINTILLATION DETECTORS
See SCINTILLATION COUNTERS
SCLERA
See EYES
SCOTLAND
See UNITED KINGDOM
SCRAP
Recycling plastic scrap: Injection molding. January 1973-August 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-August 1989, 15:726 (R;US)
Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion, 15:114 (R;US)
SEALS
Reactor coolant seal testing under station blackout conditions, 15:529 (J;US)
Rotordynamic coefficients for labyrinth seals calculated by means of a finite difference technique, 15:989 (RA;US)
SEAS
See also ATLANTIC OCEAN
Late Eocene impact events recorded in deep-sea sediments, 15:1483 (RA;US)
SEAWATER
Impact production of NO and reduced species, 15:1540 (RA;US)
Seawater strontium isotopes at the Cretaceous-Tertiary boundary, 15:1498 (RA;US)
SEAWEEDS
Preliminary study for creation of kelp forest. (2) On relation between surface form of artificial algal substratum and colonization of young Ecklonia cava plant, 15:1413 (R;JP;In Japanese)
SEBACEOUS GLANDS
See SKIN
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY COSMIC RADIATION
Secondary cosmic ray measurements in the stratosphere near Campinas, Brazil, and South Atlantic, Africa, 15:1672 (RA;BR)
SECONDARY RECOVERY
See ENHANCED RECOVERY
SECURITY
See also NATIONAL SECURITY
Application of item and personnel tracking to materials control, 15:216 (R;US)
SEDIMENT BASINS
See SETTLING PONDS
SEDIMENT-WATER INTERFACES
Briefing report to the EPA (Environmental Protection Agency) Science Advisory Board: The apparent effects threshold approach. Briefing report (Final), 15:1335 (R;US)
SEDIMENTARY ROCKS
Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)
SEDIMENTS
300 Area process trench sediment analysis report, 15:1304 (R;US)
Role of colloidal organic matter in the marine geochemistry of PCBs (polychlorinated biphenyls). Doctoral thesis, 15:1330 (R;US)
SEEDS
Molecular biology of seed storage proteins and lectins, 15:1367 (B;US)
SEISMIC ARRAYS
Siting survey and configuration optimization of a new regional array in the Federal Republic of Germany. Report for 15 December 1987-15 December 1988, 15:1542 (R;DE)
SEISMIC EVENTS
The evolution of seismic design criteria at the Idaho Chemical Processing Plant, 15:1320 (R;US)

SELLAFIELD REPROCESSING PLANT
A reassessment of criticality safety in the Sellafield separation plant, 15:211 (J;US)
SEMICONDUCTOR COUNTERS
See SEMICONDUCTOR DETECTORS
SEMICONDUCTOR DETECTORS
See also GE SEMICONDUCTOR DETECTORS
SI SEMICONDUCTOR DETECTORS
Cryogenic detectors for particle physics, 15:1168 (R;FR)
Current status of InAsSb strained-layer superlattice infrared detectors: Demonstration of a high detectivity, 10 μm photodiode, 15:255 (R;US)
SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR LASERS
SEMICONDUCTOR RESISTORS
TRANSISTORS
Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)
The effects of heavy particle radiation on semiconductor devices, 15:1211 (R;US)
SEMICONDUCTOR JUNCTIONS
See also HETEROJUNCTIONS
P-N JUNCTIONS
Multijunction III-V solar cells: Recent and projected results, 15:257 (BA;US)
SEMICONDUCTOR LASERS
Implanted-planar-buried-heterostructure, graded-index, separate-confinement-heterostructure laser in GaAs/AlGaAs, 15:1040 (J;US)
Pigtailed single-mode diode lasers. Final report, 20 September 1988-30 April 1989, 15:1026 (R;US)
SEMICONDUCTOR MATERIALS
Investigation of radiation effects on semiconductor devices and integrated circuits. Technical report, 17 April 1984-17 June 1988, 15:1210 (R;US)
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)
[Metal and semiconductor passivation]: Foreign trip report, September 23–October 8, 1989, 15:769 (R;US)
SEMICONDUCTOR RESISTORS
Energy ratings for metal oxide varistors under repetitively pulsed operation, 15:1948 (R;US)
SEQUOYAH NUCLEAR POWER PLANT UNIT-1
See SEQUOYAH-1 REACTOR
SEQUOYAH NUCLEAR POWER PLANT UNIT-2
See SEQUOYAH-2 REACTOR
SEQUOYAH-1 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
SEQUOYAH-2 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
SERIES EXPANSION
Asymptotic expansions for constant-composition Dew-Bubble curves near the critical locus, 15:1061 (J;US)
SETTLING PONDS
Savannah River Laboratory Seepage Basins: Waste site assessment report, 15:1305 (R;US)
SEWAGE
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Risk assessment Department of Energy Kansas City Plant (DOE/KCP) PCB discharge to Blue River Sewage Treatment Plant, Kansas City, Missouri: Final, 15:732 (R;US)
SHAFTS
Shaft adjuster, 15:1079 (P;US)
SHALE MINING
See OIL SHALE MINING
SHEATHS (FUEL)
See FUEL CANS
SHEETS
Pulsed TIG welding of pipes. Final report, 15:773 (R;DE;In German)
SHELL MODELS
Double Gamow–Teller strength in nuclei, 15:1813 (J;US)
SHF RADIATION
See RADIOWAVE RADIATION
SHIELDING
See also MAGNETIC SHIELDING
Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)
Space nuclear reactor shields for manned and unmanned applications, 15:400 (R;US)
SHIPPINGPORT PRESSURIZED WATER REACTOR
See SHIPPINGPORT REACTOR
SHIPPINGPORT REACTOR
Completion of the Shippingport reactor decommissioning, 15:487 (R;US)
Shippingport Station Decommissioning Project: Removal of piping and equipment and removal of primary system components, 15:203 (R;US)
SHIPS
Calculation of steady and transient torsional vibrations of marine diesels of different system configurations and geometry, 15:741 (R;DE;In German)
Statistical prediction of the ship's propulsive power, 15:694 (R;DE;In German)
SHOCK WAVES
Characterizing transient vibrations using band limited moments, 15:1233 (R;US)
Shock compression studies of condensed matter, 15:947 (R;US)
SHORT CIRCUITS
See ELECTRICAL FAULTS
SHOWER COUNTERS
Some questions of using the algebraic coding theory for construction of special-purpose processors in high energy physics spectrometers, 15:1165 (R;SU)
The soudan 2 experiment, 15:1153 (R;US)
SI SEMICONDUCTOR DETECTORS
Development of novel semiconductor detectors for the detection of ionizing radiation, 15:1171 (R;DE;In German)
Mechanical and thermal behavior of a prototype support structure for a large silicon vertex detector (BCD), 15:1163 (R;US)
Preamplifier for silicon particle detectors, 15:1188 (RA;DD)
SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES
SID
See SUDDEN IONOSPHERIC DISTURBANCE
SIGNALS
Development of an expert system for signal validation, 15:420 (J;US)
SILICA
Studies of the adsorption/desorption behavior of explosive-like molecules, 15:1222 (R;US)
SILICA GEL
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)
SILICON
Advances in material/cell/submodule research in the DOE/SERI amorphous silicon research project, 15:258 (BA;US)
Analytical chemical diagnostic testing of environmental exposed thin-film PV modules, 15:259 (BA;US)
Doping dependence of minority carrier lifetime in Ga-doped silicon, 15:904 (BA;US)
Measurement of the occupation lengths of channeled 17-MeV electrons and 54-MeV electrons and positrons in silicon by means of channeling radiation, 15:1862 (J;US)
Molecular-dynamics simulation of thin-film growth, 15:899 (BA;US)

Raman and RBS studies of ion implanted semiconductors, 15:869 (R;US)
Recent results on ion-beam hydrogenation of amorphous silicon, 15:900 (BA;US)
Silicon material quality and throughput: The high and the low, the fast and the slow, 15:256 (BA;US)
Subnanosecond x-ray diffraction from laser-shocked crystals, 15:915 (J;US)
Substrate heating for the formation of silicon-on-insulator structures by oxygen implantation. Final report, 15:888 (R;US)
The odyssey of thin-film amorphous silicon photovoltaics, 15:898 (BA;US)

SILICON 28 REACTIONS
A calorimeter for relativistic heavy-ion experiments, 15:1203 (J;NL)

SILICON 28 TARGET
Selectivity in heavy ion transfer reactions, 15:1786 (R;FR;In French)

SILICON ALLOYS
Basic characteristics of an Au-Si-liquid metal ion source, 15:1699 (RA;DD)
Dangling-bond states in a-Si,Ge:H,F measured by temperature-dependent μtau, 15:902 (BA;US)
Mass spectrometry of liquid metal ion sources, 15:1700 (RA;DD)

SILICON CARBIDES
Arcjet validation of surface catalycity using a viscous shock-layer approach, 15:755 (RA;FR)
Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
Dynamic porosity variations in ceramics, 15:828 (R;US)
Empirical and analytical determination of the fracture resistance of a TiB_2 particle/SiC matrix composite, 15:824 (R;US)
Synthesis and characterization of VLS [vapor-liquid-solid] silicon carbide whisker reinforced reaction bonded silicon nitride, 15:827 (R;US)
The demonstration of monolithic and composite ceramics in aircraft gas turbine combustors, 15:818 (RA;US)

SILICON NITRIDES
Dynamic porosity variations in ceramics, 15:828 (R;US)
Glow-discharge synthesis of silicon nitride precursor powders, 15:845 (J;US)
Preparation and evaluation of silicon nitride matrices for silicon nitride-SiC fiber composites. M.S. Thesis Final Technical Report, 15:830 (R;US)
Synthesis and characterization of VLS [vapor-liquid-solid] silicon carbide whisker reinforced reaction bonded silicon nitride, 15:827 (R;US)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICON SOLAR CELLS
Accelerated aging test method for a-Si pr module, 15:245 (RA;JP;In Japanese)
Antimony-doped dendritic web silicon solar cells, 15:260 (BA;US)
Influence of oxygen on the performance of silicon solar cells, 15:262 (BA;US)
Measurement precautions for high-resistivity silicon solar cells, 15:263 (BA;US)
Silicon material quality and throughput: The high and the low, the fast and the slow, 15:256 (BA;US)
The effect of parasitic absorption losses on light trapping in thin silicon solar cells, 15:264 (BA;US)
The effects of high level injection on the performance of high intensity, high efficiency silicon solar cells, 15:269 (BA;US)
The odyssey of thin-film amorphous silicon photovoltaics, 15:898 (BA;US)

SILICOSIS
See PNEUMOCONIOSES

SILVER 108 TARGET
Possibility of transient effects during the emission of intermediate mass fragments, 15:1801 (R;DE)

SILVER COMPOUNDS
Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$, 15:876 (R;US)

SILVER ISOTOPES
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)

SIMULATION
See also COMPUTERIZED SIMULATION
Analysis of phenomena at paralleling between power systems by AC-DC power simulator, 15:301 (R;JP;In Japanese)

SIMULATORS (REACTOR)
See REACTOR SIMULATORS

SITE CHARACTERIZATION
Natural phenomena analyses, Hanford Site, Washington, 15:1319 (R;US)
Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060), 15:1311 (R;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)

SKELETAL FOSSILS
See FOSSILS

SKELETON
Dose-response analysis of heavy metal toxicants in man: Direct in vivo assessment of body burden, 15:935 (BA;US)

SKIN
The oncogenic action of ionizing radiation on rat skin: Progress report, February 1, 1989–January 31, 1990, 15:1425 (R;US)

SKYRMIONS
See SOLITONS

SLC
See STANFORD LINEAR COLLIDER

SLUDGES
Evaluation of VOC (volatile organic compound) emissions from landfarming operations, 15:1254 (R;US)
In-drum vitrification of transuranium waste sludge using microwave energy, 15:169 (R;US)
Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)

SLUGS (FUEL)
See FUEL RODS

SLURRIES
See also FUEL SLURRIES
Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries, 15:199 (P;US)

SLURRIES (FUEL)
See FUEL SLURRIES

SLURRY PIPELINES
Amending the Mineral Lands Leasing Act of 1920 with respect to the movement of coal over public lands, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 8, 1988, 15:40 (B;US)
H.R. 402: A bill to amend the Mineral Leasing Act of 1920 with respect to the movement of coal over public lands, and for other purposes. Introduced in the House of Representatives, One Hundredth First Congress, First Session, January 3, 1989, 15:38 (B;US)

SMALL BUSINESSES
Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report, 15:651 (R;US)

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Hydraulic design on shaft-type energy dissipator of head-tank spillway, 15:237 (R;JP;In Japanese)

SMOKES
United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)

SN METHOD
See DISCRETE ORDINATE METHOD

SNR REACTOR
The TEX-I real-time expert system, applied to situation assessment for the SNR-300 reactor, 15:396 (J;US)

SNR-1 REACTOR
See SNR REACTOR
SNR-300 REACTOR
See SNR REACTOR
SODIUM ALLOYS
Electronic-structure study of the Na-Ga and Ni-In intermetallic compounds using x-ray photoemission spectroscopy. Technical report, 15:751 (R;US)
SODIUM CITRATES
See SODIUM COMPOUNDS
SODIUM COMPOUNDS
Molal dissociation quotients of water in sodium trifluoromethanesulfonate solutions to high temperatures, 15:948 (J;US)
SODIUM IODIDE DETECTORS
See NAI DETECTORS
SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS
SODIUM MINERALS
See MINERALS
SODIUM-SULFUR BATTERIES
Development of sodium-sulfur batteries for space power applications, 15:585 (BA;US)
Glass electrolytes and some of their applications, 15:550 (RA;US)
Life cycle testing of sodium/sulfur satellite battery cells, 15:584 (BA;US)
Sodium sulfur battery flight experiment definition study, 15:561 (RA;US)
Sodium sulfur cell design considerations for power applications, 15:583 (BA;US)
SODIUM-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
SOIL-STRUCTURE INTERACTIONS
Modal identification and system identification for the soil-structure system, 15:236 (R;JP;In Japanese)
SOILS
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Contribution of subsoil and aquifer microorganisms to groundwater quality. Technical report, 1 July 1988-30 June 1989. (Final), 15:1334 (R;US)
Nitrogen fertilization of young yellow poplar and loblolly pine plantations at differing frequencies, 15:1306 (J;US)
[Field-scale water and solute flux in soils]: Foreign trip report, September 21–30, 1989, 15:1416 (R;US)
SOL-GEL PROCESS
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)
SOLAR ACTIVITY
See also SOLAR FLARES
SOLAR PROMINENCES
SOLAR RADIO BURSTS
SOLAR WIND
SUNSPOTS
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)
Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous, 15:1600 (R;US)
Asymptotic Solutions
Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies, 15:1552 (RA;FR)
Auroral Zones
Solar activity and EL Nino: the auroral connection, 15:1681 (RA;BR)
Damping
The excitation and damping of solar oscillations, 15:1550 (RA;FR)
Data Analysis
Investigation of ground-based observations of solar oscillations at Stanford, 15:1575 (R;US)
Solar g-mode oscillations: Comparison of SMM-ACRIM and ground-based observations. Final report, 1 July 1987-30 June 1988, 15:1576 (R;US)
Eigenvalues
Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies, 15:1552 (RA;FR)
Geomagnetic Field
Solar modulation on annual and semi-annual geomagnetic variations, 15:1641 (RA;BR;In Portuguese)
Helium 3
Nonlinear studies of solar gravity modes driven by nuclear burning of He3 in the core, 15:1551 (RA;FR)
Interactions
Proceedings of the 1. Latin-American Conference on Space Geophysics, 15:1554 (R;BR)
Interplanetary Space
Trends in environmentally induced spacecraft anomalies, 15:1687 (RA;BR)
Magnetic Storms
Trends in environmentally induced spacecraft anomalies, 15:1687 (RA;BR)
Magnetohydrodynamics
MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988, 15:1602 (R;US)
Measuring Instruments
Solar oscillations instrumentation and measurement theory, 15:1553 (RA;FR)
Meetings
Proceedings of the 1. Latin-American Conference on Space Geophysics, 15:1554 (R;BR)
Rivers
Solar activity and EL Nino: the auroral connection, 15:1681 (RA;BR)
Solar activity and EL nino, 15:1562 (RA;BR)
Spectroscopy
MM. wavelength spectroscopic observations of solar activity region, 15:1566 (RA;BR)
Time Dependence
Solar modulation on annual and semi-annual geomagnetic variations, 15:1641 (RA;BR;In Portuguese)
Wavelengths
MM. wavelength spectroscopic observations of solar activity region, 15:1566 (RA;BR)
SOLAR ATMOSPHERE
See also CHROMOSPHERE
PHOTOSPHERE
Scientific background and design specifications for a near-earth heliospheric imager. Final report, 1 March 1985-30 September 1987, 15:1547 (R;US)
SOLAR BATTERIES
See SOLAR CELL ARRAYS
SOLAR CELL ARRAYS
Advances in thin-film solar cells for lightweight space photovoltaic power, 15:248 (R;US)
Comparative thermal analysis of the space station Freedom photovoltaic deployable boom structure using TRASYS, NEVADA, and SINDA programs, 15:250 (R;US)
Space station freedom solar array design development, 15:247 (R;US)
SOLAR CELL RECEIVERS
See SOLAR RECEIVERS
SOLAR CELLS
See also ALUMINIUM ARSENIDE SOLAR CELLS
CASCADE SOLAR CELLS
GALLIUM ARSENIDE SOLAR CELLS

GALLIUM PHOSPHIDE SOLAR CELLS
INDIUM PHOSPHIDE SOLAR CELLS
SILICON SOLAR CELLS
Advances in thin-film solar cells for lightweight space photovoltaic power, 15:248 (R;US)
Electroplating of copper. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:795 (R;US)
Evaluation of photovoltaic modules in downtown of Tokyo, 15:271 (RA;JP;In Japanese)
InP (Indium Phosphide): !nto the future, 15:246 (R;US)
Multijunction III-V solar cells: Recent and projected results, 15:257 (BA;US)
Solar cell radiation handbook. Addendum 1: 1982-1988, 15:249 (R;US)

SOLAR COLLECTORS
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)

SOLAR CONCENTRATORS
A 31%-efficient GaAs/silicon mechanically stacked, multijunction concentrator solar cell, 15:289 (BA;US)
A summary of recent photovoltaic concentrator technology developments, 15:286 (BA;US)
Concentrator efficiencies of 29.2% for a GaAs cell and 24.8% for a mounted cell-lens assembly, 15:291 (BA;US)
Minority carrier lifetime degradation in Si concentrator solar cells, 15:290 (BA;US)
Recent advances in high-efficiency InGaAs concentrator cells, 15:288 (BA;US)

SOLAR CORONA
Joint Solar Dynamics Project data summary (3rd): Solar magnetic field, chromospheric and coronal observations near the time of the 18 March 1988 solar eclipse. Technical note, 15:1601 (R;US)
Scientific background and design specifications for a near-earth heliospheric imager. Final report, 1 March 1985-30 September 1987, 15:1547 (R;US)

SOLAR ENERGY
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)
Advances in material/cell/submodule research in the DOE/SERI amorphous silicon research project, 15:258 (BA;US)
SERI [Solar Energy Research Institute] Resource Assessment Project: FY 1987 annual progress report, 15:239 (R;US)

SOLAR FLARES
Solar interplanetary coupling, 15:1555 (RA;BR)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)
Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous, 15:1600 (R;US)
The evolution of energetic particles and the emitted radiation in solar flares. Ph.D. Thesis, 15:1584 (R;US)

SOLAR FLUX
Oscillations in D-region absorption at periods of one to two months, 15:1586 (R;GB)

SOLAR NEUTRINOS
Dark matter and the solar neutrino problem: Can particle physics provide a single solution, 15:1568 (R;US)

SOLAR PROMINENCES
Global Alfiven modes in solar physics preliminary studies, 15:1560 (RA;BR)
Solar interplanetary coupling, 15:1555 (RA;BR)

SOLAR RADIATION
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)
Global problems in solar-terrestrial research, 15:1635 (RA;BR)
SERI [Solar Energy Research Institute] Resource Assessment Project: FY 1987 annual progress report, 15:239 (R;US)
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)
Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous, 15:1600 (R;US)

SOLAR RADIO BURSTS
Generation mechanism of type III radio emission in the solar wind, 15:1561 (RA;BR)
Solar-Geophysical Data Number 492, August 1985. Part 2 (comprehensive reports). Data for February 1985, August, September 1983, and miscellanea, 15:1597 (R;US)
Solar-Geophysical Data Number 533, January 1989. Part 2 (comprehensive reports). Data for July 1988, and miscellaneous, 15:1600 (R;US)

SOLAR RECEIVERS
Evaluation of the SOLAR ONE and CESA-I experimental receiver and storage systems, 15:287 (BA;US)

SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS

SOLAR SPACE HEATING
Contribution to the modelling of passive solar buildings. Validation and study of the sensitivity factors, 15:283 (R;FR;In French)
Delayed thermal supply in a building using a heat collector and storage porous concrete wall, 15:282 (R;FR;In French)
Study and Experiments of a solar energy system with air collector, underground heat storage and recovery with a heat pump, 15:284 (R;FR;In French)
Thermal performance evaluation of passive and hybrid solar systems using a low cost methodology (solar space heating in two Italian schools), 15:281 (R;IT)

SOLAR SYSTEM
Chemical evolution: A solar system perspective, 15:1588 (RA;US)
Organic solids produced from simple C/H/O/N ices by charged particles - Applications to the outer solar system, 15:1609 (J;US)

SOLAR THERMAL CONVERSION
Abstracts of 1988 JSES-JWEA joint conference, 15:238 (R;JP;In Japanese)

SOLAR THERMAL POWER PLANTS
Estimated performance and future potential of solar dynamic and photovoltaic power systems for selected LEO and HEO missions, 15:274 (R;US)
Flight experiment of thermal energy storage, 15:276 (R;US)
Solar dynamic power module design, 15:277 (R;US)

SOLAR THERMAL RECEIVERS
See SOLAR RECEIVERS

SOLAR WIND
MHD (magnetohydrodynamic) modeling of solar and interplanetary processes. Final report, 1 October 1986-30 September 1988, 15:1602 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)

SOLID ELECTROLYTES
Glass electrolytes and some of their applications, 15:550 (RA;US)

SOLID STATE LASERS
See also NEODYMIUM LASERS
SEMICONDUCTOR LASERS
Blue-green (450-nm) upconversion Tm^{3+}:YLF laser, 15:1045 (J;US)
Development of the cn- solid-state vibrational laser. Final report, 1 August 1985-31 October 1988, 15:1018 (R;US)
New, efficient optically pumped solid-state lasers. Final report, 15 August 1984-14 November 1988, 15:1027 (R;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)

SOLID STATE PHYSICS
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)

SOLID WASTES
See also SCRAP
Isotopic effects on solubility-limited mass transfer, 15:156 (R;US)
Northeast regional biomass energy program: Progress report, July 1989–September 1989, 15:231 (R;US)

SOLID-STATE PLASMA
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)

SOLIDS
Acceleration instability in elastic-plastic solids. I. Numerical simulations of plate acceleration, 15:1860 (J;US)
Acceleration instability in elastic-plastic solids. II. Analytical techniques, 15:1859 (J;US)
Hole and antihole profiles in nonphotochemical hole-burned spectra, 15:957 (J;US)
The 11th Werner Brandt workshop on charged particle penetration phenomena, 15:1850 (R;US)

SOLITONS
Linking the Gauss-Bonnet-Chern theorem, essential HOPF maps and membrane solitons with exotic spin and statistics, 15:1763 (R;US)
Solitosynthesis: Cosmological evolution of non-topological solitons, 15:1580 (R;US)
Statistical fluctuations as the origin of nontopological solitons, 15:1581 (R;US)

SOLS
See also AEROSOLS
Sol-gel processes and materials. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:123 (R;US)

SOLVENTS
Case studies of existing treatment applied to hazardous waste banned from landfill: Phase 2. Summary of waste-minimization case-study results. Final report, 15:723 (R;US)

SOUTH DAKOTA
Southwestern Low-level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:218 (B;US)

SOVIET UNION
See USSR

SPACE FLIGHT
Returned Solar Max hardware degradation study results, 15:784 (RA;US)
Workshop on Two-Phase Fluid Behavior in a Space Environment, 15:1056 (R;US)

SPACE HEATING
See also SOLAR SPACE HEATING
Domestic warm-air heating systems using low-grade heat sources, 15:673 (R;GB)

SPACE POWER REACTORS
CSTI High Capacity Power, 15:401 (R;US)
Challenges for future space power systems, 15:275 (R;US)
Comparison of solar photovoltaic and nuclear reactor power systems for a human-tended lunar observatory, 15:272 (R;US)
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Generation of numerical grids for COMMIX-1B calculation of GCR thermal and flow fields, 15:402 (J;US)
Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 4: Concepts selection, conceptual designs, recommendations, 15:398 (R;US)
Megawatt Class Nuclear Space Power Systems (MCNSPS) conceptual design and evaluation report. Volume 1. Objectives, summary results and introduction. Final report, 15:397 (R;US)
Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 3, technologies 2: Power conversion. Final report, 15:399 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)
Space nuclear reactor shields for manned and unmanned applications, 15:400 (R;US)

SPACE SHUTTLES
Calculation of scramjet performance, 15:695 (R;JP;In Japanese)
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)

SPACE VEHICLES
See also SPACE SHUTTLES
A survey of advanced battery systems for space applications, 15:552 (RA;US)
Plasma flow processes within magnetic nozzle configurations, 15:1002 (B;US)

SPACECRAFT POWER SUPPLIES
'Hytec' - New concept for a thermally regenerative electrochemical cell, 15:670 (BA;US)
Development of parallel algorithms for electrical power management in space applications, 15:330 (RA;US)
Development of sodium-sulfur batteries for space power applications, 15:585 (BA;US)
Electrochemical behavior of niobium triselenide cathode in lithium secondary cells, 15:572 (BA;US)
European fuel cell research and development projects, 15:671 (BA;US)
Life cycle testing of sodium/sulfur satellite battery cells, 15:584 (BA;US)
Sodium sulfur cell design considerations for power applications, 15:583 (BA;US)

SPECIES DIVERSITY
Biodiversity, 15:1392 (R;US)
Executive overview of World Wildlife's conference on consequences of the greenhouse effect for biological diversity: Final project report, 15:1253 (R;US)

SPECTRA (NEUTRON)
See NEUTRON SPECTRA

SPEED INDICATORS
See VELOCIMETERS

SPENT FUEL CASKS
Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)
Evaluation of shielding analysis methods for spent fuel casks, 15:125 (R;US)
Inherent criticality safety margins in spent fuel transportation casks, 15:126 (R;US)
Long-term materials testing of transportable storage cask containment and basket materials, 15:129 (J;US)
Minimum-weight highway transporters for nuclear spent-fuel casks, 15:132 (J;US)
Spent fuel performance in geologic repository environments, 15:168 (R;US)
Status of spent fuel shipping cask development, 15:987 (R;US)
Status of spent-fuel transportation system development, 15:131 (J;US)

The contribution of spent-fuel shipping cask residual contamination to the transportation source term, 15:130 (J;US)

SPENT FUEL ELEMENTS
Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions, 15:183 (J;US)
Inherent criticality safety margins in spent fuel transportation casks, 15:126 (R;US)

SPENT FUEL STORAGE
See also MONITORED RETRIEVABLE STORAGE
Comparison of radiation sources from selected point depletion codes, 15:541 (J;US)
Control of clarity and radioactivity in fuel storage basin water, 15:136 (RA;US)
Water filtration problems at the Idaho Chemical Processing Plant Fuel Storage Area, 15:124 (J;US)

SPENT FUELS
Analysis of a hypothetical criticality excursion during misloading of a high-capacity spent-fuel cask, 15:1008 (J;US)
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
Characteristics of spent fuel and high-level waste, 15:192 (J;US)
Estimated routine radiation doses to transportation workers in alternative spent-fuel transportation systems, 15:204 (J;US)
Estimating collective doses to transport workers with the RADTRAN III transport risk assessment code, 15:208 (J;US)
LWR spent-fuel radiochemical measurements and comparison with ORIGEN2 predictions, 15:184 (J;US)
Long-term materials testing of transportable storage cask containment and basket materials, 15:129 (J;US)
Microstructural examination of oxidized spent PWR fuel by transmission electron microscopy, 15:375 (J;NL)
Minimum-weight highway transporters for nuclear spent-fuel casks, 15:132 (J;US)
Oversight-a key ingredient in the HLW repository program, 15:186 (J;US)
Safeguards issues relevant to geologic disposal of spent nuclear fuels, 15:152 (R;US)
Status of spent-fuel transportation system development, 15:131 (J;US)
Studies on the back end of the nuclear fuel cycle, 15:413 (J;US)
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)
The contribution of spent-fuel shipping cask residual contamination to the transportation source term, 15:130 (J;US)
The incentives and feasibility for direct measurement of spent nuclear fuel characteristics in the Federal Waste Management System, 15:163 (R;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)

SPENT LIQUORS
Kraft recovery boiler physical and chemical processes, 15:699 (B;US)

SPICULES
See SOLAR PROMINENCES

SPILLWAY
Hydraulic design on shaft-type energy dissipator of head-tank spillway, 15:237 (R;JP;In Japanese)

SPINACH
Spectral, photophysical, and stability properties of isolated photosystem II reaction center, 15:1378 (J;US)

SPONTANEOUS FISSION
A new system for analyzing neutron multiplicities: Characterization and some specific applications, 15:1805 (R;US)
Biomodal spontaneous fission, 15:1791 (R;US)

SPORADIC E
Long-term laser radar observation of sporadic sodium layers at 23°S: a correlative and statistical study, 15:1647 (RA;BR)

SPRAY PONDS
See COOLING PONDS

SPRAYED COATINGS
Vacuum plasma spray coating, 15:757 (RA;US)

SPREAD F
Magnetic activity effects on range type spread-F and vertical plasma drifts at Fortaleza and Huancayo from ionosonde measurements, 15:1646 (RA;BR)

SQUID DEVICES
Analysis of an R-SQUID noise thermometer. Doctoral thesis, 15:994 (R;FI)
Integrating bolometers for infrared-detector arrays. Technical report (Final), 15:993 (R;US)
Principles and applications of SQUIDs, 15:1012 (J;US)
Superconducting stripline resonators and high-T_c materials, 15:983 (R;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)
Wide-band superconductive Chirp filters, 15:982 (R;US)

STAINLESS STEEL-18-4-1
See STAINLESS STEELS

STAINLESS STEEL-19-9DL
See STAINLESS STEELS

STAINLESS STEEL-304
4.2 K fracture toughness of 304 stainless steel in a magnetic field, 15:780 (R;US)

STAINLESS STEEL-304L
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)

STAINLESS STEEL-316
Mechanical properties and microstructural stability of advanced steam cycle materials: Interim report for period, September 1987–August 1989, 15:305 (R;US)

STAINLESS STEEL-316L
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)

STAINLESS STEEL-440
Nucleation and growth mechanisms in ion-plated TiN films on steel substrates, 15:819 (R;US)

STAINLESS STEELS
Accelerated aging embrittlement of cast duplex stainless steel: Activation energy for extrapolation, 15:763 (R;US)
Hydrogen assisted cracking of palladium modified PH 13-8 Mo stainless steel, 15:799 (R;US)
Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C, 15:395 (J;US)
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)
[Welding and melting by electron and laser beams]: Foreign trip report, September 11–October 2, 1988, 15:788 (R;US)

STANDARD ELECTROWEAK MODEL
See WEINBERG-SALAM GAUGE MODEL

STANDING CROP
See BIOMASS

STANFORD LINEAR COLLIDER
Precision measurements of the SLC spectrometer magnets, 15:1131 (J;NL)

STAR EVOLUTION
Near-infrared spectroscopy of young stellar objects. Ph.D. Thesis, 15:1606 (B;US)

STARCH
Bio- and photodegradable copolymers derived from low-cost feedstocks, 15:698 (R;US)

STARS
See also BINARY STARS
MAGNETIC STARS
NEUTRON STARS
Near-infrared spectroscopy of young stellar objects. Ph.D. Thesis, 15:1606 (B;US)

START-UP (REACTOR)
See REACTOR START-UP

STATIONARY POLLUTANT SOURCES
Atmospheric modeling of air pollution. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 15:1276 (R;US)

STEAM GENERATORS
An improved steam generator model for the SASSYS code, 15:393 (R;US)
Analysis of loss-of-feedwater transients in MB-2 using RELAP5/MOD2, 15:513 (J;US)
Leak suppression at steam generator man-, hand-, and eyeholes, 15:370 (J;US)
Nickel electroplating of steam generator tubes (kiss sleeving process), 15:376 (J;US)
STEAM SYSTEMS
Acoustic monitoring of BWR main steam safety relief valves, 15:546 (J;US)
STEAM TURBINES
Evaluation of fire-retardant fluids for turbine bearing lubricants: Final report, 15:303 (R;US)
STEEL INDUSTRY
See METAL INDUSTRY
STEEL-000KH25
See STAINLESS STEELS
STEEL-000KH28
See STAINLESS STEELS
STEEL-00KH20N32T
See STAINLESS STEELS
STEEL-03KH13AG13
See STAINLESS STEELS
STEEL-0KH18G8N2T
See STAINLESS STEELS
STEEL-12KH2MV8FB
See STEELS
STEEL-12KH2V5FB
See STEELS
STEEL-30N9K4
See NICKEL STEELS
STEELS
See also AUSTENITIC STEELS
NICKEL STEELS
Chemical analysis by X-ray fluorescence, of niobium in high-strength plate steels, 15:927 (R;BR;In Portuguese)
Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989, 15:753 (R;US)
Electrodeposition of cadmium from aqueous fluoborate electrolytes, 15:801 (B;US)
Estimating the remanent life of boiler pressure parts: Pt. 3. A metallographic technique for life assessment of parent 1Cr1/2Mo steel, 15:761 (R;GB)
Nucleation and growth mechanisms in ion-plated TiN films on steel substrates, 15:819 (R;US)
Steel and concrete containment models: Analyses and tests conducted to failure, 15:538 (J;US)
STELLARATORS
See also TORSATRON STELLARATOR
Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-Wave heating: Progress report No. 3, July 16, 1988–July 15, 1989, 15:1892 (R;US)
STELLITE 6
A modified ASTM G-75 abrasion test helps select candidate alloys for service in a corrosive and abrasive slurry, 15:176 (R;US)
STEM CELLS
[The hematopoietic stem cell]: Foreign trip report, September 27–October 11, 1989, 15:1389 (R;US)
STIRLING ENGINES
On the dynamic response of pressure transmission lines in the research of helium-charged free piston Stirling engines, 15:742 (R;US)
Two-dimensional numerical simulation of a Stirling engine heat exchanger, 15:1054 (R;US)
STOCKS
See INVENTORIES
STOODY
See STELLITE 6
STOPPING POWER
Implementation of an universal stopping power code to the ES 1055 computer, 15:1833 (RA;DD)
STOPPING POWER (TOTAL ATOMIC)
See STOPPING POWER
STOPPING POWER (TOTAL LINEAR)
See STOPPING POWER
STOPPING POWER (TOTAL MASS)
See STOPPING POWER
STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE
STORAGE (WASTES)
See WASTE STORAGE
STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE FACILITIES
S. 674: A bill to regulate above ground storage tanks having the capacity to store at least one million gallons of petroleum, and for other purposes. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989, 15:83 (B;US)
STORAGE RINGS
See also HERA STORAGE RING
PEP STORAGE RINGS
SUPERCONDUCTING SUPER COLLIDER
CANU workshop on polarization physics at COSY, 15:1125 (R;DE;In German)
CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, 15:1147 (R;DE;In German)
Emittance growth in a storage ring due to ground motion, 15:1143 (R;US)
Emulating conventional operator interfaces on window based workstations, 15:1148 (R;US)
Impedance calculations for 2-D and 3-D structures and the impedance budget of 7-GeV APS [Advanced Photon Source] storage ring, 15:1142 (R;US)
Rf stability, control and bunch lengthening in electron synchrotron storage rings, 15:1101 (R;US)
The positron accumulator ring for the APS, 15:1145 (R;US)
STORES
See COMMERCIAL BUILDINGS
STOVES
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)
STRAND BREAKS
The effect of radiation penetration on DNA single-strand breaks in rat skin explants, 15:1426 (R;US)
STRATEGIC DEFENSE INITIATIVE
See BALLISTIC MISSILE DEFENSE
STRATEGIC PETROLEUM RESERVE
Calculation of natural convection boundary layer profiles using the local similarity approach including turbulence and mixed convection, 15:46 (R;US)
Security problems at the Department of Energy's Strategic Petroleum Reserve. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, One Hundredth Congress, Second Session, December 7, 1988, 15:85 (B;US)
Strategic Petroleum Reserve Protective force. Introduced in the House of Representatives, One Hundredth Congress, Second Session, September 26, 1988, 15:84 (B;US)
STRATOSPHERE
Stratospheric electric fields due to electrified convective clouds, 15:1683 (RA;BR)
STRENGTH (FRACTURE)
See FRACTURE PROPERTIES
STRESS (BIOLOGICAL)
See BIOLOGICAL STRESS
STRESS ANALYSIS
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)
STRING MODELS
Special points in three-generation moduli space, 15:1761 (J;US)

STRONTIUM
Use of bioadsorbents for removing dissolved metals from dilute solutions, 15:181 (B;US)

STRONTIUM 90
Diffusion-controlled ^{90}Sr release from spent fuel under uranium-saturated conditions, 15:183 (J;US)
Investigation of the transfer of strontium-90, cesium-137; cobalt-60, and manganese-54 from soil to plant, and of the soil parameters most affecting the transfer. Final report, 15:1307 (R;DE;In German)

STRONTIUM COMPOUNDS
See also STRONTIUM OXIDES
SUNY X-3 beamline at NSLS [National Synchrotron Light Source], 15:1851 (R;US)

STRONTIUM OXIDES
Bulk superconductivity above 30 K in T^*-phase compounds, 15:861 (J;US)
Characterization and superconducting properties of phases in the Bi-Sr-Cu-O system, 15:844 (J;US)
Energy dispersions of single-crystalline $Bi_{2.0}Sr_{1.8}Ca_{0.8}La_{0.3}Cu_{2.1}O_{8+\delta}$ superconductors determined using angle-resolved photoelectron spectroscopy, 15:857 (J;US)
Flux pinning by precipitates in the Bi-Sr-Ca-Cu-O system, 15:862 (J;US)
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Neutron scattering study of the magnetic excitations in metallic and superconducting $La_{2-x}Sr_xCuO_{4-y}$, 15:856 (J;US)
Spectroscopic evidence of two-dimensional character of the 90 K $Bi_2(Sr,La,Ca)_3Cu_2O_8$ superconductors, 15:847 (J;US)
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Valence-band states in $Bi_2(Ca,Sr,La)_3Cu_2O_8$, 15:863 (J;US)

STRUCTURAL BUCKLING
See DEFORMATION

STRUCTURE-ACTIVITY RELATIONSHIPS
Structure-activity studies on ^{99m}Tc phenolic aminocarboxyllic acid hepatobiliary agente, 15:1400 (RA;AR)

STRUCTURES (BUILDINGS)
See BUILDINGS

STRUCTURES (MECHANICS)
See MECHANICAL STRUCTURES

STYRENE POLYMERS
See POLYSTYRENE

SUBBITUMINOUS COAL
Oxidation and explosive limits of low-rank coal, Volume 1: Final report, 15:20 (R;US)

SUBCRITICAL FLOW
See LAMINAR FLOW

SUBCRITICALITY
Subcritical measurements of the WINCO slab tank experiment using the source-jerk technique, 15:120 (R;US)

SUBURBS
See URBAN AREAS

SUDDEN IONOSPHERIC DISTURBANCE
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 492, August 1985. Part 1 (prompt reports). Data for July, June 1985, and late data, 15:1596 (R;US)

SULFITE WASTE LIQUOR
See SPENT LIQUORS

SULFONATES
Molal dissociation quotients of water in sodium trifluoromethanesulfonate solutions to high temperatures, 15:948 (J;US)

SULFONES
Membrane separation processes in the petrochemical industry: Phase 2, Final report, October 31, 1985–September 30, 1987, 15:700 (R;US)

SULFUR
Covalent bonding of sulfur on Ni(001): S as a prototypical adsorbate catalytic poisoner, 15:812 (J;US)
STM study of the structure of sulfur ($2\sqrt{3} \times 2\sqrt{3}$)R30° overlayer on rhenium (0001), 15:781 (R;US)

SULFUR DIOXIDE
Gas reburning-sorbent injection for controlling SO_{chl} and NO_{chl} utility boilers, 15:312 (B;US)
SO_2 and NOx control technology research, development, and demonstration. Report for 1982-March 1989, 15:311 (R;US)
SO_2-NO_x control in a staged slagging combustor with hydrated lime injection, 15:29 (R;US)
Trends of seasonal haziness and sulfur emissions over the eastern US, 15:1275 (R;US)
United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)

SULFUR HYDRIDES
See HYDROGEN SULFIDES

SULFUR IONS
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)

SULFUR ISOTOPES
Conversion of enriched isotopes of sulfur from SF_6 to a suitable compound for feed to the electromagnetic calutron separators, 15:917 (R;US)

SULFUR OXIDES
See also SULFUR DIOXIDE
National emissions report, 1985: National Emissions Data Systems (NEDS) of the Aerometric and Emissions Reporting System (AEROS). Final report, 15:1289 (R;US)

SULFUR SULFIDES
See SULFUR

SUMMER-1 REACTOR
Total organizational team building at the V.C. Summer Nuclear Station, 15:363 (J;US)

SUN
Nonlinear studies of solar gravity modes driven by nuclear burning of He3 in the core, 15:1551 (RA;FR)
Oscillations of solar models with internal element diffusion, 15:1613 (J;US)

SUNSPOTS
Solar-Geophysical Data Nnumber 533, January 1989. Part 1 (prompt reports). Data for December, November 1988, and late data, 15:1599 (R;US)
Solar-Geophysical Data Number 438, February 1981. Part 1 (prompt reports). Data for January 1981, December 1980 and late data, 15:1598 (R;US)
Two forecasts for investigation of generation mechanism of sunspots, 15:1565 (RA;BR)

SUPER HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

SUPERALLOYS
See HEAT RESISTING ALLOYS

SUPERCOMPUTERS
Large-scale problems and supercomputing in the Department of Energy, 15:2005 (J;US)

SUPERCONDUCTING CABLES
Application of superconductors to motors, generators, and transmission lines, 15:1009 (J;US)
Conventional wire and cable technology, 15:1010 (J;US)
Further studies of transverse stress effects in Cable-In-Conduit Conductors, 15:998 (R;US)

SUPERCONDUCTING CAVITY RESONATORS
Status of superconducting rf cavity development, 15:1111 (R;US)
Test results on a CEBAF/Cornell prototype superconducting cavity fabricated by TRW, 15:1130 (BA;US)

SUPERCONDUCTING COILS
Compact torsatron reactors, 15:1013 (J;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)

SUPERCONDUCTING COLLOID DETECTORS
Improved performance of low-Tc superconductors for detection of minimum-ionizing particles, 15:1161 (R;US)

SUPERCONDUCTING DEVICES
See also SQUID DEVICES
SUPERCONDUCTING CAVITY RESONATORS
SUPERCONDUCTING COLLOID DETECTORS
SUPERCONDUCTING GENERATORS
SUPERCONDUCTING MAGNETS
SUPERCONDUCTING MOTORS
Superconducting components for infrared and millimeter-wave receivers, 15:1011 (J;US)

SUPERCONDUCTING FILMS
Superconducting film fabrication by the sol-gel process, 15:825 (R;US)

SUPERCONDUCTING GENERATORS
Application of superconductors to motors, generators, and transmission lines, 15:1009 (J;US)

SUPERCONDUCTING MAGNETS
MSCAP [Magnet System Circuitry Analysis Program] simulations of TESPE magnet safety transients, 15:1931 (R;US)
PLC-based interlock system for superconducting magnets, 15:1014 (J;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)
The status of superconducting magnet safety research, 15:1934 (R;US)
[Superconducting magnet test facilities at CERN [European Organization for Nuclear Research] and modifications to the cryogenic system for the AGS Experiment 840]: Foreign trip report, September 21, 1989–September 24, 1989, 15:1117 (R;US)
[Testing superconducting magnets for the HERA project]: Foreign trip report, September 16–September 24, 1989, 15:1118 (R;US)

SUPERCONDUCTING MOTORS
Application of superconductors to motors, generators, and transmission lines, 15:1009 (J;US)

SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
A blanket design, apparatus, and fabrication techniques for the mass production of multilayer insulation blankets for the Superconducting Super Collider, 15:1124 (R;US)
SSC [Superconducting Super Collider] site evaluations, 15:1091 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 1, Instrumentation and experimental preparation (300K–80K), 15:1122 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 2, Laboratory results (300K–80K), 15:1123 (R;US)

SUPERCONDUCTING WIRES
Conventional wire and cable technology, 15:1010 (J;US)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)

SUPERCONDUCTIVITY
Advances in applied superconductivity, 15:645 (RA;US)
MX chains: 1-D analog of CuO planes?, 15:1872 (R;US)
Solid-state research. Quarterly technical report, 1 May-31 July 1988, 15:1068 (R;US)

SUPERCONDUCTORS
Development of inherently safe and environmentally acceptable intelligent processing technologies for HTS materials, 15:877 (R;US)
Epitaxial growth and properties of YBaCuO thin films, 15:826 (R;DE)
Gap-modulation infrared spectroscopy of high transition temperature superconductors, 15:1875 (J;US)
Micro-scale simulation of dynamic compaction of oxide and metal powder mixture, 15:837 (R;US)
Nearest-neighbor repulsion in electron-doped high-temperature cuprate superconductors, 15:1876 (J;US)
Researches on amorphous perovskite, 15:1871 (R;JP;In Japanese)
Superconductive materials and devices. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:995 (R;US)
Superconductor precursor mixtures made by precipitation method, 15:1016 (P;US)

SUPERCRITICAL FLOW
See TURBULENT FLOW

SUPERCRITICAL FLUID CHROMATOGRAPHY
The use of gas chromatography/matrix isolation infrared spectroscopy (GC/MI-IR) and supercritical fluid chromatography (SPC) for waste characterization, 15:24 (R;US)

SUPERFUND
Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
Procedures for completion and deletion of National Priorities List sites, 15:617 (R;US)
Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report, 15:733 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)

SUPERNOVA REMNANTS
Radio emission from young supernova remnants - Effects of an inhomogeneous circumstellar medium, 15:1611 (J;US)

SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY

SURFACE CLEANING
Foam and gel decontamination techniques, 15:967 (R;US)

SURFACE MINING ACTS
H.R. 1376: A bill to amend titles II, V, and VII of the Surface Mining Control and Reclamation Act of 1977 to make the mining of coal without a permit a criminal offense, and for other purposes. Introduced in the House of Representatives, One Hundredth First Congress, First Session, March 13, 1989, 15:39 (B;US)
H.R. 4804: A bill to amend titles I, II, IV and V of the Surface Mining Control and Reclamation Act of 1977, and to add a new title X, to encourage the remining and reclamation of abandoned mined lands by active mining operations, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 14, 198, 15:41 (B;US)

SURFACE-ACTIVE AGENTS
See SURFACTANTS

SURFACES
Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986, 15:1062 (R;US)

SURFACTANTS
Guidelines help select reservoirs for $NaHCO_3$ EOR, 15:60 (J;US)
Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)
SURGES
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
SURRY POWER STATION UNIT-1
See SURRY-1 REACTOR
SURRY POWER STATION UNIT-2
See SURRY-2 REACTOR
SURRY-1 REACTOR
Accident progression analysis of past severe accidents, 15:503 (R;US)
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)
SURRY-2 REACTOR
Accident progression analysis of past severe accidents, 15:503 (R;US)
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)
SURRY-3 REACTOR
Accident progression analysis of past severe accidents, 15:503 (R;US)
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)
SURRY-4 REACTOR
Accident progression analysis of past severe accidents, 15:503 (R;US)
Barge shipment and reactor handling of a castor V/21 cask, 15:207 (J;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
Time/motion observations of reactor loading, transportation, and dry unloading of an oversized truck spent-fuel shipment, 15:206 (J;US)
SUSPENSIONS (FUEL)
See FUEL SLURRIES
SWEAT GLANDS
See SKIN
SWITCHES
High speed transfer switch with 50 kA and 50 kV, 15:1953 (R;US)
Study on wave forms of lightning surges and disconnecting switch surges, 15:323 (R;JP;In Japanese)
SYNCHROPHASOTRONS
See SYNCHROTRONS
SYNCHROTRON RADIATION
Synchrotron radiation as a tool for study of biological structure, 15:1395 (R;US)
Synchrotron radiation sources to provide new probes of matter, 15:223 (J;US)
SYNCHROTRON RADIATION SOURCES
See also NSLS
Status report on the radio frequency accelerating system of the APS [Advanced Photon Source] at Argonne, 15:1110 (R;US)
The uses of synchrotron radiation sources for elemental and chemical microanalysis, 15:1212 (R;US)
SYNCHROTRONS
See also BONN SYNCHROTRON
FERMILAB ACCELERATOR
FERMILAB TEVATRON
NSLS
CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich, 15:1147 (R;DE;In German)
SYNTHESIS GAS
Novel experimental studies for coal liquefaction: Final report, 15:5 (R;US)
SYNTHETASES
See LIGASES
SYNTHETIC FUELS
Food and petroleum resources from the Chinese tallow tree. Phase 2. Final report, 15:647 (R;US)
SYNTHETIC FUELS REFINERIES
Cool Water Coal Gasification Program: Environmental monitoring plan, (4th) quarterly report, 1 October through 31 December, 1987, 15:11 (R;US)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS
SYSTEMS ANALYSIS
A new balance-of-plant model for the SASSYS-1 LMR systems analysis code, 15:391 (R;US)

T

TANDEM ELECTROSTATIC ACCELERATORS
Operation of the electrostatic accelerators in 1985, 15:1099 (RA;DD)
TANK FARMS
See STORAGE FACILITIES
TANKS
Criticality safety analysis of a borated-concrete absorber, 15:118 (R;US)
TANTALUM
Photoelectron diffraction determination of the geometry of a clean metal surface: Ta(100), 15:811 (J;US)
Solvents extraction of niobium and tantalum, 15:940 (R;BR;In Portuguese)
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)
TAR SANDS
See OIL SANDS
TARGETS
See also ALUMINIUM 27 TARGET
BERYLLIUM 9 TARGET
BORON 10 TARGET
CALCIUM 40 TARGET
CALCIUM 42 TARGET
CARBON 12 TARGET
DEUTERIUM TARGET
GOLD 197 TARGET
HELIUM 3 TARGET
HOLMIUM 165 TARGET
HYDROGEN 1 TARGET
ION BEAM TARGETS
IRON 54 TARGET
IRON 56 TARGET
LASER TARGETS
OXYGEN 16 TARGET
PLUTONIUM 239 TARGET
SILICON 28 TARGET
SILVER 108 TARGET
TIN 120 TARGET
TITANIUM 48 TARGET
TRITIUM TARGET
TUNGSTEN 184 TARGET
URANIUM 238 TARGET
YTTRIUM 89 TARGET
Position, rotation, and intensity invariant recognizing method, 15:1080 (P;US)
TAU LEPTONS
See TAU PARTICLES
TAU PARTICLES
The τ one-prong problem and recent measurements by the HRS [High Resolution Spectrometer] collaboration, 15:1719 (R;US)

TAUONS
See TAU PARTICLES
TECHNETIUM COMPLEXES
Simple method for the preparation of difficult ^{99m}Tc complexes using surface adsorbed stannous ions, 15:962 (RA;AR)
[The use of technetium and rhenium in nuclear medicine]: Foreign trip report, September 3, 1989–September 9, 1989, 15:959 (R;US)
TECHNOLOGY ASSESSMENT
Status of spent fuel shipping cask development, 15:987 (R;US)
TELEPHONES
Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report, 15:651 (R;US)
TELESCOPE COUNTERS
Development and test of a ΔE - E annular detector telescope, 15:1178 (RA;DD)
Experimental determination of the ^{3}He(d,p)^{4}He background portion in time-correlated associated-particle method (TCAPM) measurements of about 19 MeV neutron energy, 15:1191 (RA;DD)
TELESCOPES
A Normal Incidence X-ray Telescope (NIXT) sounding rocket payload. Final report, 1 November 1982-31 January 1989, 15:1173 (R;US)
TEMPERATURE MEASUREMENT
Analysis of an R-SQUID noise thermometer. Doctoral thesis, 15:994 (R;FI)
TENDONS (STRUCTURAL)
See CABLES
TERBIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
TERBIUM COMPOUNDS
Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$, 15:876 (R;US)
TERBIUM ISOTOPES
A search for long-lived radionuclides produced by fast-neutron irradiations of copper, silver, europium, terbium, and hafnium, 15:1918 (R;US)
TERNARY FISSION
Fortran programs KASSAMBA and STRIDEM, 15:1811 (RA;DD)
TERRESTRIAL BACKGROUND
See BACKGROUND RADIATION
TERRESTRIAL ECOSYSTEMS
Assessment of the importance of acidic fogwater and cloudwater in affecting terrestrial vegetation: Some important case studies, 15:1256 (R;US)
TERTIARY RECOVERY
See ENHANCED RECOVERY
TEST REACTORS
See also FFTF REACTOR
GRENOBLE REACTOR
HFIR REACTOR
A nuclear reactor alarm display system utilizing AI techniques for alarm filtering, 15:459 (BA;US)
TESTING (BIOLOGICAL)
See BIOASSAY
TESTING (MATERIALS)
See MATERIALS TESTING
TEVATRON
See FERMILAB TEVATRON
TEXTILE INDUSTRY
Industrial-hygiene summary report of Hanes Dye and Finishing Company, Winston-Salem, Inc., September 13-14, 1977, 15:1270 (R;US)
Minimising operating costs in continuous fabric washing, 15:705 (R;GB)
TFTR DEVICE
See TFTR TOKAMAK
TFTR REACTORS
See TFTR TOKAMAK
TFTR TOKAMAK
Cryosorption of helium on argon frost TFTR [Tokamak Fusion Test Reactor] neutral beamlines, 15:1970 (R;US)
In situ spectroscopic measurements of erosion behavior of Tokamak Fusion Test Reactor-redeposited carbon materials under high-flux plasma bombardment in PISCES-A (Plasma Interactive Surface Component Experimental Station-A), 15:910 (J;US)
THE GEYSERS
See GEYSERS GEOTHERMAL FIELD
THERAPEUTIC AGENTS
See DRUGS
THERMAL BATTERIES
Heat-transfer optimization of a high-spin thermal battery, 15:575 (BA;US)
Investigation of alternate electrolytes for thermal batteries, 15:576 (BA;US)
THERMAL ENERGY STORAGE EQUIPMENT
Development of ice self-release mechanisms: Final report, 15:716 (R;US)
Evaluation of the SOLAR ONE and CESA-I experimental receiver and storage systems, 15:287 (BA;US)
THERMAL INSULATION
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 1, Instrumentation and experimental preparation (300K–80K), 15:1122 (R;US)
Thermal performance measurements of a 100 percent polyester MLI [multilayer insulation] system for the Superconducting Super Collider: Part 2, Laboratory results (300K–80K), 15:1123 (R;US)
THERMAL PHOTOGRAPHY
See INFRARED THERMOGRAPHY
THERMAL POLLUTION (AIR)
See AIR POLLUTION
THERMAL POLLUTION (WATER)
See WATER POLLUTION
THERMAL POWER PLANTS
See also COMBINED-CYCLE POWER PLANTS
FOSSIL-FUEL POWER PLANTS
GEOTHERMAL POWER PLANTS
NUCLEAR POWER PLANTS
OCEAN THERMAL POWER PLANTS
SOLAR THERMAL POWER PLANTS
Behaviors and scale effect of wave reflection and run-up on armored breakwater, 15:1089 (R;JP;In Japanese)
Survey on synthesis technologies of methanol as an alternative fuel, 15:228 (R;JP;In Japanese)
THERMAL STORAGE
See HEAT STORAGE
THERMIONIC DIODES
Charge exchange effects in ion diodes, 15:1707 (J;US)
The effect of charge exchange processes on ion diode impedance, 15:1708 (J;US)
THERMIONIC FUEL ELEMENTS
Characterization of compliant thermal conductive tungsten material for thermionic element application, 15:656 (BA;US)
THERMODYNAMICS
Behavior of a quantum particle in contact with a classical heat bath, 15:1856 (J;US)
THERMOLUMINESCENT DOSEMETERS
A comparison of TLD and Monte Carlo calculation for beta dosimetry, 15:1846 (J;US)
THERMOMECHANICAL TREATMENTS
The science of thermomechanical processing, 15:778 (R;US)
THERMONUCLEAR FUELS
Fusion fuel purification during the Tritium Systems Test Assembly 3-week loop experiment, 15:1959 (R;US)
THERMONUCLEAR REACTIONS
See also MUON-CATALYZED FUSION
Cold nuclear fusion and muon-catalyzed fusion. January 1976-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1976-April 1989, 15:1718 (R;US)
Hot fusion, cold fusion, 15:1886 (J;FR;In French)
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)

Thermonuclear-reaction bibliography with cross-section data for four advanced reactions. Interim report, June 1988-January 1989, 15:1887 (R;US)

THERMONUCLEAR REACTOR MATERIALS
A 14-MeV beam-plasma neutron source for materials testing, 15:1971 (R;US)
Measurement of long-lived isotopes and helium production in fusion materials, 15:1922 (R;US)
Volatility from copper and tungsten alloys for fusion reactor applications, 15:1938 (R;US)
[Advanced ceramics for fusion applications]: Foreign trip report, June 17, 1988–June 25, 1988, 15:1965 (R;US)
[International Energy Agency workshop on fusion materials database]: Foreign trip report, June 5, 1988–June 11, 1988, 15:1964 (R;US)
[Low activation alloys for fusion reactors]: Foreign trip report, August 13, 1988–August 27, 1988, 15:1966 (R;US)
[Materials for magnetic fusion energy systems]: Foreign trip report, August 30, 1988–September 9, 1988, 15:1967 (R;US)
[Radiation damage correlation for fusion conditions]: Foreign trip report, September 25, 1989–October 5, 1989, 15:1968 (R;US)
[Studies on fusion materials]: Foreign trip report, June 5, 1989–June 15, 1989, 15:1963 (R;US)

THERMONUCLEAR REACTORS
See also TOKAMAK TYPE REACTORS
Identification and selection of initiating events for experimental fusion facilities, 15:1937 (R;US)
Irradiation creep in fusion reactor candidate austentic stainless steels at 60 to 400°C, 15:395 (J;US)
Status of magnetic fusion, 15:1912 (J;US)
Toroidal magnetic fields in terms of field-line invariants, 15:1943 (R;US)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOSPHERE
Studying the interaction between ionosphere and thermosphere in polar regions using incoherent scatter facilities: the case of EISCAT, 15:1654 (RA;BR)
Thermospheric models: a short review, 15:1671 (RA;BR)

THIN FILMS
Analytical chemical diagnostic testing of environmental exposed thin-film PV modules, 15:259 (BA;US)
Electrochemical and galvanic corrosion effects in thin-film photovoltaic modules, 15:901 (BA;US)
Harmonic generation with ultrashort pulses using nonlinear poled polymeric thin films, 15:912 (J;US)
Micron-thin Nb films recovered from Mbar shock pressures, 15:800 (R;US)
Molecular-dynamics simulation of thin-film growth, 15:899 (BA;US)
Recent results on ion-beam hydrogenation of amorphous silicon, 15:900 (BA;US)
Solid-state research. Quarterly technical report, 1 August-31 October 1988, 15:1071 (R;US)

THIOBACILLUS FERROXIDANS
Genetic manipulation of acidophilic bacteria, 15:7 (R;US)

THOMAS-FERMI MODEL
Charge states of high Z atoms in a strong laser field, 15:1696 (R;US)

THOMAS-FERMI-DIRAC MODEL
See THOMAS-FERMI MODEL

THORAX
See CHEST

THOREX PROCESS
Thorium determination by X-ray Fluorescence Spectrometry in simulated thorex process solutions, 15:925 (R;BR;In Portuguese)

THORIUM
Determination of thorium, uranium and transuranium isotopes in siliceous and refractory materials by high-resolution alpha spectrometry, 15:111 (R;US)
Thorium determination by X-ray Fluorescence Spectrometry in simulated thorex process solutions, 15:925 (R;BR;In Portuguese)

THORIUM 222
Gai replies, 15:1796 (J;US)

THORIUM 226
Comment on "Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei", 15:1795 (J;US)
Gai replies, 15:1796 (J;US)

THORIUM 232
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
Results of the radiological survey at 4 Hancock Street, Lodi, New Jersey (LJ060), 15:1311 (R;US)
Results of the radiological survey at 5 Hancock Street, Lodi, New Jersey (LJ029), 15:1309 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)
Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)

THORIUM IONS
Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles, 15:1711 (J;US)

THORIUM OXIDES
Transmitted spectra of single slabs driven by (deuterium-tritium) neutrons at the LOTUS facility, 15:1975 (J;US)

THREE MILE ISLAND-2 REACTOR
Criticality safety margins provided by moderator control in the TMI-2 dry storage cask, 15:490 (R;US)
GPU licensed operator requalification program using the Penn State Breazeale Nuclear Research Reactor, 15:479 (J;US)

THULIUM
Magnetic excitations in thulium metal, 15:1849 (R;US)

TIME-OF-FLIGHT METHOD
Dangling-bond states in a-Si,Ge:H,F measured by temperature-dependent μtau, 15:902 (BA;US)

TIN
Irradiation of superheated superconducting tin granules with low energy photons, at temperatures below 1 k, 15:776 (R;FR)

TIN 120
Giant *M*1 resonance in ^{120}Sn and the quenching of the nucleon spin *g* factors, 15:1792 (J;US)

TIN 120 TARGET
Giant *M*1 resonance in ^{120}Sn and the quenching of the nucleon spin *g* factors, 15:1792 (J;US)

TIN COMPOUNDS
See also TIN TELLURIDES
Paramagnetic neutron scattering from Pd_2MnSn, 15:808 (J;US)

TIN TELLURIDES
Investigation of the influence material on initial stages of epitaxial growth of $Pb_{0.8}Sn_{0.2}Te$ layer during the growing from solution-melt, 15:942 (RA;SU;In Russian)

TISSUE EQUIVALENT CHAMBERS
See BRAGG GRAY CHAMBERS

TITANIUM
On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)
X-ray microprobe for the microcharacterization of materials, 15:1848 (R;US)

TITANIUM 48 TARGET
Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy, 15:1778 (RA;DD)

TITANIUM ALLOYS
See also TITANIUM BASE ALLOYS
Deformation twinning in ordered intermetallic compounds, 15:765 (R;US)

TITANIUM BASE ALLOYS
Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress, 15:772 (R;DE;In German)
TITANIUM BORIDES
Empirical and analytical determination of the fracture resistance of a TiB_2 particle/SiC matrix composite, 15:824 (R;US)
TITANIUM CARBIDES
Characterization of ceramics and intermetallics fabricated by self-propagating high-temperature synthesis, 15:785 (R;US)
TITANIUM COMPOUNDS
See also TITANIUM BORIDES
TITANIUM CARBIDES
TITANIUM NITRIDES
KFA-experiments on metal-hydrogen systems analyzing the claim of 'cold nuclear fusion' events, 15:1781 (R;DE)
TITANIUM NITRIDES
Correlation of interface structure with adhesive strength of ion-plated TiN hard coatings, 15:820 (R;US)
Nucleation and growth mechanisms in ion-plated TiN films on steel substrates, 15:819 (R;US)
TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS
TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS
TOKAMAK DEVICES
See also COMPACT IGNITION TOKAMAK
ITER TOKAMAK
1989 failure rate screening data for fusion reliability and risk analysis, 15:1930 (R;US)
Control of helium accumulation by fishbones, 15:1921 (R;US)
DIII-D power supply fault system, 15:1913 (J;US)
Experimental evidence of increased electron temperature, plasma potential, and ion energy near an ICRF antenna Faraday shield, 15:1925 (R;US)
Kinetic ray tracing in toroidal geometry with application to mode-converted ion-Bernstein waves, 15:1906 (R;US)
MHD equilibrium and stability considerations for high-aspect-ratio ARIES-I tokamak reactors, 15:1888 (R;US)
Methodology for assessing the radiological consequences of radioactive releases from the CIT [Compact Ignition Tokamak] facility at PPPL [Princeton Plasma Physics Laboratory], 15:1282 (R;US)
Safety in the ARIES Tokamak Design Study, 15:1935 (R;US)
The ARIES-I high-field-tokamak reactor: Design-point determination and parametric studies, 15:1958 (R;US)
The tokamak as a neutron source, 15:1969 (R;US)
Vertical stability requirements for ARIES-I reactor, 15:1901 (R;US)
TOKAMAK FUSION TEST REACTOR
See TFTR TOKAMAK
TOKAMAK TYPE REACTORS
See also COMPACT IGNITION TOKAMAK
NET TOKAMAK
TFTR TOKAMAK
Applications of neutral beam and RF technologies, 15:1973 (J;US)
TONSILS
See LYMPHATIC SYSTEM
TOROIDAL PINCH DEVICES
The data acquisition and control system for Thomson scattering on ATF, 15:1976 (J;US)
TOROIDAL PINCH TYPE REACTORS
See TOROIDAL PINCH DEVICES
TORSATRON STELLARATOR
See also ATF TORSATRON
Compact torsatron reactors, 15:1013 (J;US)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOUGHNESS (FRACTURE)
See FRACTURE PROPERTIES
TOWERS (EXTRACTION)
See EXTRACTION COLUMNS
TOXIC MATERIALS
See also TOXINS
Feasibility of using GEMS (Graphical Exposure Modeling System) to perform risk assessments using SARA (Superfund Amendment and Reauthorization Act of 1986), toxic release inventory information. Technical report, 15:618 (R;US)
Information profiles on potential occupational hazards: Inorganic chromium compounds. Draft report (Second), 15:1460 (R;US)
Information profiles on potential occupational hazards: Organic anhydrides. Draft report (Second), 15:1459 (R;US)
Pharmacokinetics in risk assessment: drinking water and health. Volume 8, 15:1445 (R;US)
Walk-through survey of Aerovox Industries, Inc., New Bedford, Massachusetts, January 5, 1976, 15:1456 (R;US)
TOXINS
Crystallization of isoelectrically homogeneous cholera toxin, 15:1408 (J;US)
Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report, 15:1419 (R;DE;In German)
TRACE AMOUNTS
Modelling the atmospheric transport of trace metals from Europe to the North Sea and the Baltic Sea, 15:1258 (R;DE)
TRACE ELEMENTS
See TRACE AMOUNTS
TRAJECTORIES
Analytical treatment of electron trajectory straightener issues in free-electron lasers, 15:1030 (R;US)
Sporadicity: Between periodic and chaotic dynamical behaviors, 15:1716 (J;US)
TRANSALASKA PIPELINE
See ALASKA OIL PIPELINE
TRANSFER (ENERGY)
See ENERGY TRANSFER
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFER (IN ORGANISM)
See RADIONUCLIDE KINETICS
TRANSFER (MASS)
See MASS TRANSFER
TRANSFERASES
Altered regulation of lipid biosynthesis in a mutant of Arabidopsis deficient in chloroplast glycerol-3-phosphate acyltransferase activity, 15:1380 (J;US)
TRANSFORMATIONS (ONCOGENIC)
See ONCOGENIC TRANSFORMATIONS
TRANSFORMERS
Prediction of remaining lives of 132 kV grid transformers, 15:328 (R;GB)
TRANSIENTS
A RELAP5/MOD2 model of a nuclear power plant and sensitivity study on the nodalization scheme, 15:512 (J;US)
Characterizing transient vibrations using band limited moments, 15:1233 (R;US)
TRANSISTORS
See also FIELD EFFECT TRANSISTORS
MOS TRANSISTORS
Rf transistor thermal/electrical characterization, 15:1073 (R;US)
TRANSITION ELEMENTS
See also CHROMIUM
COPPER
GOLD
IRON
MOLYBDENUM
NICKEL
NIOBIUM
SCANDIUM
TANTALUM
TITANIUM
TUNGSTEN
YTTRIUM
ZIRCONIUM
Method of inducing surface ensembles on a metal catalyst, 15:15 (P;US)

TRANSITION METALS
See TRANSITION ELEMENTS
TRANSITION RADIATION DETECTORS
Studies on the detection of transition radiation for the e/π separation in the ZEUS experiment, 15:1154 (R;DE;In German)
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSMISSION TOWERS
See POWER TRANSMISSION TOWERS
TRANSPORT (CHARGED-PARTICLE)
See CHARGED-PARTICLE TRANSPORT
TRANSPORT (GAMMA)
See PHOTON TRANSPORT
TRANSPORT (IN ORGANISMS)
See RADIONUCLIDE KINETICS
TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT
TRANSPORT (PHOTON)
See PHOTON TRANSPORT
TRANSPORT (PROTON)
See PROTON TRANSPORT
TRANSPORT (RADIATION)
See RADIATION TRANSPORT
TRANSPORT THEORY
See also NEUTRON TRANSPORT THEORY
A global existence theorem for the nonlinear BGK equation, 15:1747 (J;US)
Anomalous diffusion in a lattice-gas wind-tree model, 15:1863 (J;US)
Radiation physics as a basis of radiation chemistry and biology, 15:1834 (BA;US)
Transport equations in weak topologies of dual Banach spaces, 15:1835 (J;US)
Transport modeling and advanced computer techniques, 15:1893 (R;US)
TRANSPORTATION SECTOR
Transportation energy data book: Edition 10, 15:696 (R;US)
TRANSURANIUM COMPOUNDS
Technical evaluation of WIPP by the New Mexico environmental evaluation group, 15:185 (J;US)
TRANSURANIUM WASTES
See ALPHA-BEARING WASTES
TRAVEL
Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)
TRIASSIC PERIOD
End-triassic mass extinction event, 15:1485 (RA;US)
TRIBOLOGY
Development and use of a tribology research-in-progress data base, 15:1064 (R;US)
Fundamental mechanisms of tribology and their implications. Final technical report, 1 May 1982-31 January 1986, 15:1062 (R;US)
TRIPLET PARTICLES
See QUARKS
TRITIUM
Comparative analysis of tritium in water, 1987, 15:1344 (R;DE;In German)
Dispersion and removal of tritium released into the main cell TSTA [Tritium Systems Test Assembly], 15:1952 (R;US)
$NaNi_5Mn_2$ alloy as a tritium storage material, 15:1945 (R;US)
Separation of tritium from other hydrogen isotopes, 15:220 (R;FR)
Treatment of tritium from liquid and solid wastes for the purpose of recycling (input to an enrichment plant). Final report, 15:157 (R;DE;In German)
Uranium storage bed accident hazards evaluation, 15:1940 (R;US)
TRITIUM SYSTEMS TEST ASSEMBLY
Dispersion and removal of tritium released into the main cell TSTA [Tritium Systems Test Assembly], 15:1952 (R;US)
Tritium handling safety and operating experience at the Tritium Systems Test Assembly, 15:1951 (R;US)
TRITIUM TARGET
Analysis of associated particle spectra in time-correlated associated-particle method (TCAPM) fission cross-section measurements at ~ 19 MeV neutron energy, 15:1778 (RA;DD)
Fortran code for the calculation of 'realistic' distributions of neutrons produced in hydrogen-isotope reactions, 15:1831 (RA;DD)
Radiative capture of tensor and vector polarized deuterons by ^3H at 400 keV, 15:1784 (J;US)
TROMBE WALLS
Delayed thermal supply in a building using a heat collector and storage porous concrete wall, 15:282 (R;FR;In French)
TRU WASTES
See ALPHA-BEARING WASTES
TRUCKS
S. 2720: A bill requiring the use by the Federal Government of certain vehicles capable of operating on alcohol or natural gas fuels or on electricity in areas not in compliance with the Clean Air Act, and for other purposes. Introduced in the Senate of the United States, One Hundredth Congress, Second Session, August 10, 1988, 15:748 (B;US)
TRX-1
See REVERSE-FIELD PINCH
TSTA
See TRITIUM SYSTEMS TEST ASSEMBLY
TUBES
Approximate methods for dynamic plastic deformation of structures, 15:766 (R;US)
Nickel electroplating of steam generator tubes (kiss sleeving process), 15:376 (J;US)
TUBES (CONDUITS)
See PIPES
TUFF
Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)
TUMORS
See NEOPLASMS
TUNGSTEN
Dynamic fracture toughness testing. Final report, 1 September 1985-28 February 1989, 15:753 (R;US)
TUNGSTEN 184 TARGET
Neutron emission cross sections on ^{184}W at 11.5 and 26 MeV and the neutron-nucleus scattering mechanism, 15:1793 (J;NL)
TUNGSTEN ALLOYS
See also TUNGSTEN BASE ALLOYS
Tensile and creep rupture behavior of P/M processed Nb-base alloy, WC-3009, 15:783 (R;US)
TUNGSTEN BASE ALLOYS
Characterization of compliant thermal conductive tungsten material for thermionic element application, 15:656 (BA;US)
TUNNEL EFFECT
On a validity of adiabatic approach to the tunneling phenomena, 15:1879 (R;DE)
TURBINE BLADES
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)
Fiber reinforced superalloys for rocket engines, 15:759 (RA;US)
Frictional corrosion on turbine blades - fatigue strength of titanium under frictional stress, 15:772 (R;DE;In German)
MATE program: erosion resistant compressor airfoil coating, volume 2. Final report, 15:829 (R;US)
Turbine rotor/stator flowfield analysis, 15:1083 (R;US)
Vacuum plasma spray coating, 15:757 (RA;US)
TURBOMACHINERY
Application of Advanced Material for Turbomachinery and Rocket Propulsion, 15:756 (R;US)
Superconducting Meissner-effect bearings for cryogenic turbomachines. Phase 1. Final report, September 1988-March 1989, 15:980 (R;US)
TURBULENT FLOW
Simultaneous multipoint measurements of density gradients and temperature in a flame: Final report, August 1, 1985–July 31, 1987, 15:972 (R;US)
TURNOVER (RADIONUCLIDES)
See RADIONUCLIDE KINETICS

TWO-BODY PROBLEM
Method for computing coupled-channels Gamow-state energies, 15:1826 (J;US)
Separable expansion for the two-body *T* matrix based on a nonsingular scattering equation, 15:1818 (J;US)
TWO-PHASE FLOW
Dynamic analysis of heated channels with time-dependent inlet temperature, heat flux, and pressure drop, 15:448 (J;US)
Transient analysis method for two-dimensional discharge flow using a two-fluid model, 15:451 (J;US)
Workshop on Two-Phase Fluid Behavior in a Space Environment, 15:1056 (R;US)
TWO-STREAM INSTABILITY
Generation mechanism of type III radio emission in the solar wind, 15:1561 (RA;BR)

U

U CODES
UDEC (Universal Distinct Element Code) Version ICG1.5: Verification and example problems, 15:162 (R;US)
UCLBL
See LAWRENCE BERKELEY LABORATORY
UCLLL
See LAWRENCE LIVERMORE LABORATORY
UHF RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION
UHF RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION
UHF RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION
UHF RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION
UJM
See JET MODEL
ULTRAHIGH FREQUENCY RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION
ULTRALOW FREQUENCY RADIATION
Peculiarity of the equatorial ULF, 15:1631 (RA;BR)
ULTRAVIOLET RADIATION
Differential sensitivity of human leukocyte subpopulations to ultraviolet light, 15:1417 (R;US)
Ultraviolet-induced photochemical damage in the ocular tissues. Final report, 15:1418 (R;US)
UNCORRELATED-JET MODEL
See JET MODEL
UNDERGROUND EXPLOSIONS
5th symposium on containment of underground nuclear explosions, 15:1228 (R;US)
Containment analysis for LLNL: 1988: Final report, 15:1231 (R;US)
Non-intrusive verification: Revision 1, 15:1234 (R;US)
UNDERGROUND STORAGE
Dollars and sense: A summary of the financial-responsibility regulations for underground storage tank systems, 15:80 (R;US)
Leak lookout: Using external leak detectors to prevent petroleum contamination from underground storage tanks, 15:81 (R;US)
Musts for USTs: A summary of the new regulations for underground storage-tank systems, 15:82 (R;US)
UNDERWATER OPERATIONS
Underwater measuring gage, 15:1343 (P;US)
UNDULATORS
See WIGGLER MAGNETS
UNIFIED GAUGE MODELS
See also WEINBERG-SALAM GAUGE MODEL
The topology of moduli space and quantum field theory, 15:1769 (J;NL)
UNION OF SOVIET SOCIALIST REPUBLICS
See USSR
UNIPOLAR TRANSISTORS
See FIELD EFFECT TRANSISTORS
UNITED KINGDOM
Emission of nitrogen oxides from a Kuhlmann nitric acid plant, 15:1264 (R;GB)
Methods for the compilation of UK (United Kingdom) air-pollutant-emission inventories. Report for 1976-1986, 15:1263 (R;GB)
United Kingdom Minerals Tearbook, 1988. Statistical data to 1987, 15:621 (R;GB)
United Kingdom smoke and sulphur dioxide monitoring: Establishment of the Basic Rural Network (October 1986). Report for April 1986-March 1987, 15:1265 (R;GB)
UNITED STATES OF AMERICA
See USA
UNIVERSE
Great attractor really a great wall, 15:1570 (R;US)
Light propagation and the distance-redshift relation in a realistic inhomogeneous universe, 15:1591 (R;US)
UNIVERSITIES
See EDUCATIONAL FACILITIES
UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY
See LAWRENCE BERKELEY LABORATORY
UNLOADING (REACTOR)
See REACTOR FUELING
URANIUM
See also NATURAL URANIUM
Application of supported liquid membranes for removal of uranium from groundwater, 15:1345 (R;US)
Contribution to calculation of distribution coefficient of the Uranium using solvent extraction, 15:112 (R;BR;In Portuguese)
Determination of thorium, uranium and transuranium isotopes in siliceous and refractory materials by high-resolution alpha spectrometry, 15:111 (R;US)
Determination of uranium (IV) in cloride solutions of enrichment columns by spectrometry with flow injection, 15:924 (R;BR;In Portuguese)
Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)
Investigation of the neptunium behavior in the electrolytic reduction separation of uranium and plutonium, 15:919 (TG;US)
Risks versus savings in the international spot market, 15:133 (J;US)
Specification and characteristics of ion selective electrode for uranium (VI), 15:923 (R;BR;In Portuguese)
Uranium (VI) determination by Radiometric Stripping Analysis (X ray), 15:922 (R;BR;In Portuguese)
Uranium determination in $UO_2(NO_3)_2$-HNO_3-H_2O system by precision densimetry, 15:926 (R;BR;In Portuguese)
URANIUM 234
Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)
URANIUM 235
Determination of U^{235} enrichment from nuclear fuel by neutronic activation, 15:930 (R;BR;In Portuguese)
Optimization of transmission method for using in safeguards, 15:929 (R;BR;In Portuguese)
URANIUM 238
Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)
Results of the radiological survey at 106 Columbia Lane, Lodi, New Jersey (LJ063), 15:1315 (R;US)
Results of the radiological survey at 24 Long Valley Road, Lodi, New Jersey (LJ048), 15:1310 (R;US)
Results of the radiological survey at Kennedy Park, Money and Sidney Streets, Lodi, New Jersey (LJ062), 15:1314 (R;US)
Results of the radiological survey at the Firemen's Memorial Park and Fire Hall No. 2, Garibaldi Avenue and Kennedy Drive, Lodi, New Jersey (LJ066), 15:1316 (R;US)
Results of the radiological survey at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), 15:1313 (R;US)

Results of the radiological survey at the property at Main Street and Highway 46, Lodi, New Jersey (LJ074), 15:1312 (R;US)

URANIUM 238 TARGET
Determination of the inhomogeneity of U-238 fission-foils by Rutherford-backscattering (RBS) measurements, 15:969 (RA;DD)

URANIUM ALLOYS
Irradiation performance of metallic fuels, 15:392 (R;US)
Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion, 15:114 (R;US)

URANIUM DIOXIDE
Characterization of aerosol particles formed during steam oxidation of an irradiated UO_2 sample, 15:519 (J;US)
Hydrogen dissolution in and relesease from nonmetals, 15:838 (J;NL)
Microstructural examination of oxidized spent PWR fuel by transmission electron microscopy, 15:375 (J;NL)

URANIUM HEXAFLUORIDE
Investigation of high-temperature materials for uranium-fluoride-based gas core reactor systems, 15:437 (J;US)

URANIUM II
See URANIUM 234

URANIUM IONS
Strong continuum-continuum couplings in the direct ionization of Ar and He atoms by 6-MeV/u U^{38+} and Th^{38+} projectiles, 15:1711 (J;US)

URANIUM ISOTOPES
See also URANIUM 234
URANIUM 235
URANIUM 238
Removal of uranium from drinking water by conventional treatment methods, 15:1347 (R;US)

URANIUM NITRATES
A comparison between criticality analyses for unreflected systems by Monte Carlo codes MCNP and MONK6A, 15:1006 (J;US)
Californium-252-source-driven noise analysis measurements for six interacting safe bottles of aqueous uranyl nitrate, 15:1007 (J;US)
Criticality experiments with mixed plutonium-uranium nitrate solution at plutonium fraction of 0.5, 0.4, and 0.2 in slab and cylindrical geometry, 15:1003 (J;US)
Validation of the scale code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry, 15:1004 (J;US)

URANIUM OXIDES
See also URANIUM DIOXIDE
Identification of secondary phases formed during unsaturated reaction of UO_2 with EJ-13 water, 15:958 (R;US)

URANIUM SILICIDES
$CeRu_2Si_2$ and URu_2Si_2: Same or different?, 15:870 (R;US)

URANUS PLANET
Equation of state data of shock compressed liquid CO_2 and synthetic Uranus, 15:1604 (R;US)

URANYL NITRATES
Uranium determination in $UO_2(NO_3)_2$-HNO_3-H_2O system by precision densimetry, 15:926 (R;BR;In Portuguese)

URBAN AREAS
Air Pollution Abatement
Using jobs/housing balance indicators for air-pollution controls. Master's thesis, 15:1290 (R;US)
Air Quality
Determination of C2 to C12 ambient air hydrocarbons in 39 US cities from 1984 through 1986, 15:1268 (R;US)
Automobiles
Local Government Operation, 15:628 (RA;US)
Automotive Fuels
Alternate vehicle fuels unit, 15:596 (RA;US)
Alternate vehicular fuels, 15:598 (RA;US)
Alternative vehicle fuels unit, 15:597 (RA;US)
Energy Management
Community and economic development, 15:594 (RA;US)
Community and economic development, 15:590 (RA;US)
Electricity management, 15:630 (RA;US)
Renewable energy unit (Year 10), 15:595 (RA;US)
Renewables, 15:603 (RA;US)
Energy Policy
Electricity management, 15:630 (RA;US)
Renewables, 15:603 (RA;US)
Fuel Systems
Alternative vehicle fuels, 15:600 (RA;US)
Analysis of programmatic fleet conversion to ethanol blends technology transfer project, 15:601 (RA;US)
Research Programs
Local Government Operation, 15:628 (RA;US)
Traffic Control
Local Government Operations, 15:627 (RA;US)
Waste Disposal
Energy and waste management, 15:602 (RA;US)
Energy and waste management, 15:593 (RA;US)
Waste-to-energy, 15:629 (RA;US)

URINALYSIS
See URINE

URINE
Determination of uranium in urine by 2-spectrometry, 15:931 (R;BR;In Portuguese)

UROGENITAL SYSTEM DISEASES
Comparative study regarding the association of alpha-2U globulin with the nephrotoxic mechanism of certain petroleum-based air force fuels. Final report 1, December 1987-30 November 1988, 15:1440 (R;US)
Health-hazard evaluation report HETA-86-381-1934, Nuclear Fuel Services, Erwin, Tennessee, 15:202 (R;US)

US DOE
See also ANL
BNL
HANFORD RESERVATION
IDAHO CHEMICAL PROCESSING PLANT
IDAHO NATIONAL ENGINEERING LABORATORY
LASL
LAWRENCE BERKELEY LABORATORY
LAWRENCE LIVERMORE LABORATORY
ORNL
ROCKY FLATS PLANT
SAVANNAH RIVER PLANT
US FERC
WIPP
WESTERN AREA POWER ADMINISTRATION
Y-12 PLANT
Clean Coal Technology Program. Hearings before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session, April 2 and 9, 1987, 15:1 (B;US)
DOE policy: Waste management QA, 15:193 (J;US)
Department of Energy Technology Annual Progress Report, 1 January-31 December 1988, 15:626 (R;DK)
Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989, 15:99 (B;US)
The continuing evolution of the Federal Radiological Emergency Response Plan, 15:1422 (R;US)

US EPA
Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)

US FERC
Federal Energy Regulatory Commission Member Term Act of 1989 and establishing the position of Assistant Secretary for Natural Gas in the Department of Energy. Hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundredth First Congress, First Session on S. 388, and S. 389, April 17, 1989, 15:99 (B;US)

US NBS REACTOR
See NBSR REACTOR

US NRC
NRC overview: Repository QA, 15:194 (J;US)
NRC regulatory information conference: Proceedings, 15:493 (R;US)
Regulatory actions and initiatives based on results of NRC operational safety assessments of fuel cycle facilities, 15:210 (J;US)
Status of the NRC's high-level waste repository licensing program, 15:190 (J;US)
The role of the Nuclear Regulatory Commission in the management of nuclear waste, 15:189 (J;US)

US REA
Competition between small business and rural electic and telephone cooperatives in nonutility business. Final report, 15:651 (R;US)

US WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT

USA
A national laboratory perspective on EOR research and development directions, 15:54 (B;US)
A summary of recent photovoltaic concentrator technology developments, 15:286 (BA;US)
Collaboration in nuclear engineering education between France and the United States: Research opportunities for US students in France, 15:433 (J;US)
Collaboration in nuclear engineering education between France and the United States: Participation of French students at Texas A & M University, 15:434 (J;US)
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)
Force structure implications of START. Study project, 15:749 (R;US)
Free market economics: Graphs and figures, 15:644 (RA;US)
Implications of the Chernobyl accident for US reactors, 15:526 (J;US)
Nuclear power: A public policy issue, 15:632 (J;US)
Oil import taxes and national security, 15:637 (RA;US)
Opportunities for conservation and alternative energy technologies, 15:638 (RA;US)
Research directions in enhanced oil recovery, 15:58 (B;US)
S. 2096: Canadian Free Trade Agreement Incentive Equalization Act. Introduced in the Senate of the United States. One Hundredth Congress, Second Session, February 25, 1988, 15:72 (B;US)
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
The American Nuclear Society's international student exchange program, 15:435 (J;US)
The University of Stuttgart IKE/University of Arizona student research program, 15:436 (J;US)
United States military strategy in the Persian Gulf. Study project, 15:45 (R;US)

USSR
Bibliography of Soviet laser developments: January-February 1988, 15:1023 (R;US)
Detection of artificial sources of nuclear radiation in space. Revision. Memorandum report, February 1980-May 1981, 15:1149 (R;US)
Force structure implications of START. Study project, 15:749 (R;US)
Monitoring sources of nuclear radiation in space. Part 1. Early 1984 observations. Revision. Memorandum report, 15:1150 (R;US)
Monitoring sources of nuclear radiation in space: 1980-1984 observations. revision. Memorandum report, April 1980-January 1985, 15:1151 (R;US)
Monitoring sources of nuclear radiation in space: 1985-1987 observations. revision. Memorandum report, 15:1152 (R;US)
Soviet reactions to follow-on-to-Lance (FOTL). Study project, 15:750 (R;US)
Soviet strategic nuclear doctrine under Gorbachev. Study project, 15:1225 (R;US)

UTERINE CERVIX CARCINOMA
See CARCINOMAS
UROGENITAL SYSTEM DISEASES

V

VA CHARACTERISTIC
See ELECTRIC CONDUCTIVITY

VACCINES
Investigation of inactivation of Clostridium botulinum toxin by nuclear radiation. Final report, 15:1419 (R;DE;In German)

VACUUM (1-760 TORR)
See LOW PRESSURE

VACUUM (133 PA-0.1 MPA)
See LOW PRESSURE

VACUUM (ROUGH)
See LOW PRESSURE

VACUUM SYSTEMS
Adaptation of dependex fittings to International Standards Organization fittings, 15:1218 (J;US)
X-ray lithography source (SXLS) vacuum system, 15:1106 (R;US)

VALENCE ELECTRONS
See ELECTRONS

VAN DE GRAAFF ACCELERATORS
Operation of the electrostatic accelerators in 1985, 15:1099 (RA;DD)

VANADIUM MINERALS
See MINERALS

VANES
Advanced methods for 3-D inelastic structural analysis for hot engine structures, 15:1084 (R;US)

VARISTORS
See SEMICONDUCTOR RESISTORS

VEGETATION
See PLANTS

VEHICLES
See also AUTOMOBILES
SPACE VEHICLES
TRUCKS
A comparative analysis of alternative fuel infrastructure requirements, 15:745 (R;US)
Methanol fueled vehicles and photochemical models: an evaluation of the state of knowledge. Appendix A-C. Technical report (Final), 15:746 (R;US)
Motor-vehicle applications for certification by the Environmental Protection Agency (EPA). September 1979-July 1989 (Citations from the NTIS data base). Report for September 1979-July 1989, 15:744 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)

VELOCIMETERS
Near-wall fluid jet velocity profile measurements using laser speckle velocimetry, 15:456 (J;US)

VENTILATION DUCTS
See DUCTS

VENTILATION SYSTEMS
Upgrade of the radioactive air emission systems at Oak Ridge National Laboratory, 15:159 (RA;US)

VENUS PLANET
Experimental study of atmospheric gases by electron impact technique, 15:1557 (RA;BR)

VERY HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

VESSELS (PRESSURE)
See PRESSURE VESSELS

VHF RADIATION
See RADIOWAVE RADIATION

VIBRATION MODES
See OSCILLATION MODES

VIRGIL C SUMMER-1 REACTOR
See SUMMER-1 REACTOR

VIRUSES
[Research on the structure of the adenovirus virion]: Foreign trip report, July 9–August 1, 1989, 15:1372 (R;US)

VISIBILITY
Trends of seasonal haziness and sulfur emissions over the eastern US, 15:1275 (R;US)

VISIBLE RADIATION
Correction by the multiple scattering of light of the measurement of the particle diameter and the number density by a ray tracing method, 15:977 (R;JP;In Japanese)
Light propagation and the distance-redshift relation in a realistic inhomogeneous universe, 15:1591 (R;US)

VOLATILE MATTER
Evaluation of VOC (volatile organic compound) emissions from landfarming operations, 15:1254 (R;US)

VOLCANOES
Assessment of the atmospheric impact of volcanic eruptions, 15:1524 (RA;US)
Catastrophic volcanism, 15:1496 (RA;US)
Catastrophic volcanism as a cause of shocked features found at the K/T boundary and in cryptoexplosion structures, 15:1497 (RA;US)
Cretaceous-Tertiary findings, paradigms and problems, 15:1508 (RA;US)
Deccan volcanism and K-T boundary signatures, 15:1506 (RA;US)
Dynamics of exploding magma chambers: Implications for K-T volcanism and mass extinctions, 15:1518 (RA;US)
Flood basalts and mass extinctions, 15:1505 (RA;US)
Mass extinctions in the deep sea, 15:1529 (RA;US)
Permo-Triassic vertebrate extinctions: A program, 15:1510 (RA;US)
Report on an international workshop on Cryptoexplosions and Catastrophes in the Geological Record, with a Special Focus on the Vredefort Structure, 15:1517 (RA;US)
Selective extinction of marine plankton at the end of the Mesozoic era: The fossil and stable isotope record, 15:1495 (RA;US)
Some volcanologic aspects of Columbia River basalt volcanism relevant to the extinction controversy, 15:1533 (RA;US)
Step-wise extinctions at the Cretaceous-Tertiary boundary and their climatic implications, 15:1501 (RA;US)
Volcanoes and global catastrophes, 15:1525 (RA;US)

VOLT-AMPERE CHARACTERISTIC
See ELECTRIC CONDUCTIVITY

VOLTAGE
See ELECTRIC POTENTIAL

VOLTAIC CELLS
See ELECTRIC BATTERIES

W

W MINUS BOSONS
Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?, 15:1751 (J;US)

W PLUS BOSONS
Are *W* pairs a detectable signature for heavy Higgs bosons at the Superconducting Super Collider?, 15:1751 (J;US)

WAPA
See WESTERN AREA POWER ADMINISTRATION

WARFARE
See also BIOLOGICAL WARFARE
CHEMICAL WARFARE
RADIOLOGICAL WARFARE
Introduction to the operational nuclear-survivability assessment process. Technical paper, 15:1226 (R;US)

WASHINGTON
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington). Volume 1 of 4. Final report, 15:604 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 1. Volume 1 of 2. Final report, 15:612 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area. (Coastal Washington) Volume 4 of 4. Final report, 15:607 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington) Volume 3 of 4. Final report, 15:606 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 1. Volume 2 of 2. Final report, 15:613 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington) Part 2. Volume 1 of 2. Final report, 15:614 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Coastal Washington). Volume 2 of 4. Final report, 15:605 (R;US)
Baseline socio-economic profiles of coastal counties in the Washington-Oregon Planning Area (Puget Sound Area, Washington). Part 2. Volume 2 of 2. Final report, 15:615 (R;US)

WASTE CHEMICALS
See CHEMICAL WASTES

WASTE DISPOSAL
See also RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Cleaning excavated soil using extraction agents: A state-of-the-art review. Final report, June 1985-January 1989, 15:1321 (R;US)
Demonstrations of technology for remediation and closure of Oak Ridge National Laboratory waste disposal sites, 15:165 (R;US)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
Risk assessment in development of municipal-sludge incineration regulations under 405(D) of the Clean Water Act, 15:1357 (R;US)
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Pesticide application, 15:722 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)
Transient phenomena in rotary-kiln incineration, 15:736 (R;US)

WASTE DISPOSAL ACTS
S. 674: A bill to regulate above ground storage tanks having the capacity to store at least one million gallons of petroleum, and for other purposes. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, March 17, 1989, 15:83 (B;US)

WASTE FORMS
The influence of penetrating gamma radiation on the reaction of simulated nuclear waste glass in tuff groundwater, 15:138 (R;US)

WASTE HEAT UTILIZATION
Waste heat recovery from a heavily contaminated waste stream. A demonstration at Tioxide UK Ltd. [Hartlepool], 15:712 (R;GB)
Waste heat recovery from the absorption stage of a sulphuric acid plant. Demonstration project at Berk Spencer Acids Ltd., London, 15:702 (R;GB)

WASTE ISOLATION PILOT PLANT
See WIPP

WASTE MANAGEMENT
See also RADIOACTIVE WASTE MANAGEMENT
WASTE DISPOSAL
WASTE STORAGE
WASTE TRANSPORTATION

Expert system technology: Tools for developing intelligent advisory systems for today's waste-management programs, 15:737 (R;US)
Geosciences. Hearings before the Subcommittee on Energy Research and Development of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, July 15, 16, 1987, 15:49 (B;US)
Guidance document for the WRITE (Waste Reduction Innovative Technology Evaluation) pilot program with state and local governments, 15:721 (R;US)
Potential technologies for collection and destruction of CFCS (chlorofluorocarbons), halons, and related compounds. Final report, March 1988-May 1989, 15:720 (R;US)
Recycling grants in Illinois: A two year review. Final report, 15:717 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Automotive and heavy-equipment maintenance, 15:719 (R;US)
Summary report of capacity at commercial facilities. Volume 2. Appendices A-E. Summary report, 15:733 (R;US)

WASTE SOLUTIONS
See LIQUID WASTES

WASTE STORAGE
Hazardous Materiel Data File (HMDF), quarterly update. Data file, 15:619 (R;US)

WASTE TRANSPORTATION
Hazardous Materiel Data File (HMDF), quarterly update. Data file, 15:619 (R;US)
The incentives and feasibility for direct measurement of spent nuclear fuel characteristics in the Federal Waste Management System, 15:163 (R;US)

WASTE WATER
Best demonstrated available technology (BDAT) background document for K099 (non CBI version). Final report, 15:1351 (R;US)
Estimation of hydraulic characteristics of the upper glacial and Magothy aquifers at East Meadow, New York, by use of aquifer tests. Water Resources Investigation, 15:1332 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Summary of risk-assessment methodologies for municipal-sludge reuse or disposal options, 15:735 (R;US)
Testing of a mobile pilot-scale continuous countercurrent ion exchange system for treatment of low-level radioactive wastewater, 15:140 (R;US)
Trace substances present as chlorination by-products in drinking and process waters, 15:1342 (J;US)
Use of bioadsorbents for removing dissolved metals from dilute solutions, 15:181 (B;US)

WASTEFORMS
See WASTE FORMS

WATER
See also DRINKING WATER
FEEDWATER
GROUND WATER
SEAWATER
WASTE WATER
Contained radiological analytical chemistry module, 15:1349 (P;US)
Effectiveness of water spray mitigation systems for accidental releases of hydrogen fluoride: Volume 4, Appendix F, Flow chamber evaluation, 15:1279 (R;US)
Effects of ozone and water stress on net photosynthetic rate of field-grown soybean leaves, 15:1444 (R;US)
Identification of secondary phases formed during unsaturated reaction of UO_2 with EJ-13 water, 15:958 (R;US)
Laser droplet heating: fast and slow heating regimes, 15:1250 (J;US)
Molal dissociation quotients of water in sodium trifluoromethanesulfonate solutions to high temperatures, 15:948 (J;US)
Water spray mitigation of hydrofluoric acid releases, 15:727 (R;US)
[Field-scale water and solute flux in soils]: Foreign trip report, September 21–30, 1989, 15:1416 (R;US)

WATER COOLANT
See WATER

WATER COOLED REACTORS
See also BWR TYPE REACTORS
HCLWR TYPE REACTORS
HFIR REACTOR
ORR REACTOR
PWR TYPE REACTORS
A critique of three methodologies for estimating the probability of containment failure due to steam explosions, 15:539 (J;US)

WATER DISTRIBUTION
See WATER SUPPLY

WATER MODERATOR
See WATER

WATER POLLUTION
Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:1338 (R;US)
Alternatives to conventional risk assessment in determining appropriate cleanup levels for Superfund remediation (Question 3105). Technical report (Final), 15:1355 (R;US)
Computation of three-dimensional advection-dominated solute transport in saturated aquifers. Final report, 15:1331 (R;US)
Ecological assessment of hazardous-waste sites: A field and laboratory reference, 15:1353 (R;US)
New Bedford Harbor Superfund Project: Acushnet River Estuary engineering feasibility study of dredging and dredged-material disposal alternatives. Report 2. Sediment and contaminant hydraulic transport investigations. Technical report, February 1986-July 1987, 15:1325 (R;US)
Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Second edition, 15:1446 (R;US)
Superfund Record of Decision (EPA Region 5): US Aviex, MI. (first remedial action), September 1988. Final report, 15:1358 (R;US)
Superfund Record of Decision (EPA Region 9): Ordot Landfill, GU. (first remedial action), September 1988. Final report, 15:1360 (R;US)
Superfund Record of Decision (EPA Region 9): San Gabriel Valley Areas 1, 2, & 4, CA. (second remedial action), September 1988, 15:1359 (R;US)

WATER POLLUTION CONTROL
Advanced precoat filtration and competitive processes for water purification. Technical report, 15:1333 (R;US)
Artic oil-spill response guide for the alaskan beaufort sea. Final report, 15:68 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Role of landfill disposal in municipal solid-waste management. Technical report (Final), 15:734 (R;US)

WATER QUALITY
Advanced precoat filtration and competitive processes for water purification. Technical report, 15:1333 (R;US)
Five-year program strategy for the Great Lakes National Program Office, FT 1989-1993, 15:1354 (R;US)
Workshop summary report: Water-quality criteria to protect wildlife resources. Report on pollutants considered to pose the greatest threat to wildlife when existing water-quality criteria are met, 15:1336 (R;US)

WATER RESOURCES
Development of dating methods of ground water (Part 1). Sampling technique of the deep ground water, 15:1350 (R;JP;In Japanese)

WATER SOLUTIONS
See AQUEOUS SOLUTIONS

WATER SUPPLY
Evaluating various adsorbents and membranes for removing radium from ground water, 15:1346 (R;US)

WATER TREATMENT
Activated-charcoal filters: Water treatment, pollution control, and industrial applications. January 1970-August 1989 (Citations from the US Patent data base). Report for January 1970-August 1989, 15:1338 (R;US)
Advanced precoat filtration and competitive processes for water purification. Technical report, 15:1333 (R;US)
Ozonization used in water and sewage treatment. January 1970-August 1989 (Citations from the NTIS data base). Report for January 1970-August 1989, 15:1340 (R;US)
Water filtration problems at the Idaho Chemical Processing Plant Fuel Storage Area, 15:124 (J;US)

WATER WELLS
St. Charles county well field monitoring project: Quarterly report, July, August and September 1989, 15:144 (R;US)

WATERBORNE PARTICLES
See PARTICULATES

WATERFLOODING
Surfactant enhanced volumetric sweep efficiency: Final report, 15:50 (R;US)

WATERSHEDS
Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)

WAVE ENERGY CONVERTERS
Technology module for shoreline wave energy conversion in the UK, 15:299 (R;GB)

WAVE PROPAGATION
Nonlinear waves. Technical report, 15:1877 (R;US)

WAVES (SHOCK)
See SHOCK WAVES

WAZ 16
See NICKEL BASE ALLOYS

WEAK NEUTRAL CURRENTS
Second class currents in the μ^--capture by polarized light nuclei, 15:1804 (R;SU)

WEATHER
Antarctic surface temperature and pressure data, 15:1239 (R;US)

WEATHERING
Mechanism of chemical weathering of mudstone. Dissolution and oxidation experiment, 15:308 (R;JP;In Japanese)

WEINBERG-SALAM GAUGE MODEL
Direct-photon searches as tests for unconventional high-energy electroweak interactions, 15:1773 (J;US)

WELDED JOINTS
Design method for pressure vessels containing randomly flawed welds. Technical report, 15:992 (R;ZA)

WELDING
[Welding under extreme conditions]: Foreign trip report, August 29, 1989–September 14, 1989, 15:791 (R;US)

WELDS
See WELDED JOINTS

WELL LOGGING EQUIPMENT
Some geometric modeling and tracking codes for Monte Carlo particle transport including direction biasing techniques, 15:1220 (J;US)

WELL STIMULATION
Guidelines help select reservoirs for $NaHCO_3$ EOR, 15:60 (J;US)

WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY

WESTERN AREA POWER ADMINISTRATION
Federal electric power: Controversy relating to construction of transmission lines, 15:650 (R;US)

WESTINGHOUSE STANDARD REACTOR
Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)
Evaluation of advanced computer systems for performing system thermal-hydraulic modeling, 15:366 (J;US)

WETLANDS
Use of wetlands under USEPA's (Environmental Protection Agency's) Region 5 Clean Lakes Program. Master's thesis, 15:1356 (R;US)

WHISTLERS
Study of spacecraft electromagnetic contamination of artificial electron beams. Final report, 1 August 1987-31 September 1988, 15:1617 (R;US)

WIGGLER MAGNETS
Self-field-induced chaotic electron motion in free electron lasers, 15:1036 (R;US)

WILD ANIMALS
Trends in radionuclide concentrations for selected wildlife and food products near the Hanford Site from 1971 through 1988, 15:166 (R;US)
Workshop summary report: Water-quality criteria to protect wildlife resources. Report on pollutants considered to pose the greatest threat to wildlife when existing water-quality criteria are met, 15:1336 (R;US)

WILDERNESS AREAS
See NATURE RESERVES

WIND GENERATORS
See ELECTRIC GENERATORS

WINDSCALE REPROCESSING PLANT
See SELLAFIELD REPROCESSING PLANT

WIPP
Results from electromagnetic surface surveys to characterize the Culebra aquifer at the WIPP [Waste Isolation Pilot Plant] site, 15:170 (R;US)
Technical evaluation of WIPP by the New Mexico environmental evaluation group, 15:185 (J;US)
Waste Isolation Pilot Plant Land Withdrawal Act of 1987. Hearing before the Subcommittee on Public Lands, National Parks and Forests of the Committee on Energy and Natural Resources, United States Senate, One Hundredth Congress, First Session on S. 1272, October 12, 1987, 15:219 (B;US)

WIRES
See also SUPERCONDUCTING WIRES
Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB), 15:1223 (R;US)

WOLF-RAYET STARS
A source of observational constraints on the structure of Wolf-Rayet winds, 15:1569 (R;US)

WOLFRAM
See TUNGSTEN

WOOD BURNING APPLIANCES
Quality-assurance procedures: Method 28A measurement of air-to-fuel ratio and minimum burn rate for wood-fired appliances, 15:1267 (R;US)

WOOD FUELS
In-situ emission factors for residential wood-combustion units. Final report, 15:1288 (R;US)

WORKERS
See PERSONNEL

WYOMING
Strategic metals (tantalum, columbium, beryllium) in pegmatites of Copper Mountain, Fremont County, Wyoming. A preliminary report. Open file report, 1987-88, 15:622 (R;US)

X

X RADIATION
The search for absorption of 1 keV X-rays by the Small Magellanic Cloud, 15:1590 (R;US)

X-RASERS
See X-RAY LASERS

X-RAY DIFFRACTION
Geochemical study of main elements and trace elements in soils of three profiles in the state of Santa Catarina, 15:920 (R;BR;In Portuguese)

X-RAY EMISSION ANALYSIS
Addition compounds between lanthanide trifluoromethane sulphonates and N,N,N',N' - tetrametilmalonamida (TMMA), 15:928 (R;BR;In Portuguese)

X-RAY EQUIPMENT
A program for calculating and plotting soft x-ray optical interaction coefficients for molecules, 15:1215 (R;US)

Flux and spectrum of neutrons generated from 25-MV medical x-ray therapy machine. Master's thesis, 15:1393 (R;US)

X-RAY LASERS
$3p^63d^8$–$3p^53d^9$ Transitions in ironlike Sb, 15:1042 (J;US)
Observation of n=2–3 and n=3–4 transitions in Li-like ions of P, S, Cl, and K in plasmas produced by line-focus laser irradiation, 15:1043 (J;US)
Wavelengths and energy levels for Ge xxiv, Ge xxv, and Ge xxvi observed in plasmas produced by line-focus laser irradiation, 15:1044 (J;US)

X-RAY RADIOGRAPHY
Activities carried out by the American College of Radiology in cooperation with the National Institute for Occupational Safety and Health. Final report, 15:1403 (R;US)
Nondestructive testing: X-ray radiography techniques. January 1975-October 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-October 1987, 15:1065 (R;US)
Nondestructive testing: X-ray radiography techniques. November 1987-August 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for November 1987-August 1989, 15:1066 (R;US)

X-RAY SPECTROMETERS
A Normal Incidence X-ray Telescope (NIXT) sounding rocket payload. Final report, 1 November 1982-31 January 1989, 15:1173 (R;US)
Separation of outer-shell satellite X-ray lines at sources of highly ionized atoms, 15:1193 (RA;DD)
Temperature control of analyzer crystals in crystal diffraction spectrometers with discontinuous optimized controllers, 15:1194 (RA;DD)

XENON
Shock compression studies of condensed matter, 15:947 (R;US)

XENON EFFECT
See XENON OSCILLATIONS

XENON OSCILLATIONS
A knowledge-based system for control of xenon-induced spatial power oscillations during load-follow operations, 15:468 (J;US)

XI MINUS
See XI MINUS PARTICLES

XI MINUS PARTICLES
New measurement of the production polarization and magnetic moment of the Ξ^- hyperon, 15:1728 (J;US)

XI-MINUS
See XI MINUS PARTICLES

Y

Y*RESONANCES
See BARYONS

Y-12 PLANT
Environmental Sciences Division Toxicology Laboratory standard operating procedures, 15:1443 (R;US)

YIELD (FUSION)
See FUSION YIELD

YTTERBIUM
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)

YTTERBIUM COMPOUNDS
Time resolved fluorescence line narrowing in ytterbium-doped inorganic glasses, 15:903 (BA;US)

YTTRIUM
On the electron affinities of the Ca, Sc, Ti and Y atoms, 15:945 (R;US)
Rare earth element and yttrium contents in fluorite samples, 15:1545 (RA;DD)
The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)

YTTRIUM 89 TARGET
^{89}Y+n resonances for E=10-740 keV and intermediate structure, 15:1790 (J;NL)

YTTRIUM 90
^{89}Y+n resonances for E=10-740 keV and intermediate structure, 15:1790 (J;NL)

YTTRIUM ALLOYS
The influence of ion-implanted yttrium on the selective oxidation of chromium in Co-25 wt.% Cr, 15:803 (J;US)

YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM COMPOUNDS

YTTRIUM COMPOUNDS
See also YTTRIUM FLUORIDES
YTTRIUM OXIDES
Metal oxide films from carboxylate precursors, 15:817 (R;US)
Rotational spin-glass properties of $Tb_{0.3}Y_{0.7}Ag$, 15:876 (R;US)
Superconducting film fabrication by the sol-gel process, 15:825 (R;US)

YTTRIUM FLUORIDES
Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)

YTTRIUM OXIDES
Angular dependence of the upper critical field of $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:864 (J;US)
Application of neutron diffraction to the characterization of residual thermal strains in $YBa_2Cu_3O_{7-\delta}$/Ag, 15:849 (J;US)
Effect of atmosphere and rare earth on liquidus relations in RE-Ba-Cu oxides, 15:841 (J;US)
Effect of silver and silver oxide additions on the mechanical and superconducting properties of $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:848 (J;US)
Environmental effects on luminescence yield of superconducting $YBa_2Cu_3O_x$, 15:842 (J;US)
Formation of coherent twins in $YBa_2Cu_3O_{7-\delta}$ superconductors, 15:843 (J;US)
High-temperature precipitation hardening of Y_2O_3 partially-stabilized ZrO_2 (Y-PSZ) single crystals, 15:840 (J;US)
Magnetic ordering and superconductivity in $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$, 15:851 (J;US)
Microstructure and electrical properties of bulk high-T_c superconductors, 15:822 (R;US)
Neutron scattering study of magnetic excitations in $YBa_2Cu_3O_{6+x}$, 15:852 (J;US)
Processing of strong flux trapping high T(subc) oxide superconductors: Center director's discretionary fund. Final report, 15:879 (R;US)
Rotational magnetic processes in $YB_2Cu_3O_7$, 15:875 (R;US)
Studies of neutral and ion transport during laser ablation of 1:2:3 superconductors by optical absorption spectroscopy, 15:1870 (R;US)
Superconducting fluctuation diamagnetism above T_c in $YBa_1Cu_3O_7$, $La_{1.8}Sr_{0.2}CuO_4$, and $Bi_{2-x}Pb_xSr_2CaCu_2O_{8+\delta}$, 15:846 (J;US)
Temperature, frequency, and rf field dependence of the surface resistance of polycrystalline $YBa_2Cu_3O_{7-x}$, 15:859 (J;US)
Upper critical field and normal-state properties of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ compounds, 15:853 (J;US)

YUCCA MOUNTAIN
Preliminary description of quaternary and late pliocene surficial deposits at Yucca Mountain and vicinity, Nye County, Nevada, 15:172 (R;US)
Sorption of radionuclides on Yucca Mountain tuffs, 15:155 (R;US)

YUKAWA POTENTIAL
Yukawa theories as effective theories of quantum chromodynamics for a large number of colors, 15:1816 (J;US)

Z

Z NEUTRAL BOSONS
Beam-polarization phenomena in high-energy e^+e^- collider physics, 15:1748 (J;US)
Direct-photon searches as tests for unconventional high-energy electroweak interactions, 15:1773 (J;US)

ZFK ROSSENDORF
Operation of the cyclotron U-120, 15:1098 (RA;DD)

Operation of the electrostatic accelerators in 1985, 15:1099 (RA;DD)

ZINC
Toxicity of zinc. July 1985-July 1989 (Citations from the NTIS database). Report for July 1985-July 1989, 15:1463 (R;US)

ZINC 74
Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)

ZINC 76
Nuclear structure in the neutron-rich doubly magic ^{78}Ni region, 15:1789 (R;US)

ZINC OXIDES
Magnetic ordering in $La_2Cu_{1-x}Zn_xO_{4-y}$, 15:865 (J;US)

ZINC TELLURIDES
Research and development of HgZnTe as an infrared material. Final Technical report, 2 August 1988-2 February 1989, 15:880 (R;US)

ZION STATION UNIT-1
See ZION-1 REACTOR

ZION STATION UNIT-2
See ZION-2 REACTOR

ZION-1 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
What was learned in developing the 1987 Zion Federal Field Exercise that can be used in planning other emergency response exercises?, 15:482 (R;US)

ZION-2 REACTOR
An analytical study of seismic threat to containment integrity, 15:496 (R;US)
The role of NUREG-1150 in accident management, 15:520 (J;US)
What was learned in developing the 1987 Zion Federal Field Exercise that can be used in planning other emergency response exercises?, 15:482 (R;US)

ZIRCALOY
Thick-film effects in the oxidation and hydriding of zirconium alloys, 15:357 (R;US)

ZIRCALOY 2
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)

ZIRCALOY 4
Correlation of waterside corrosion and cladding microstructure in high-burnup fuel and gadolinia rods, 15:335 (R;US)

ZIRCONIUM
Reduction of scrap losses in Zircaloy-2 clad zirconium-uranium alloy tube coextrusion, 15:114 (R;US)

ZIRCONIUM ALLOYS
Irradiation performance of metallic fuels, 15:392 (R;US)

ZIRCONIUM BORIDES
Achievements in Westinghouse discrete and integral fuel burnable absorber usage, 15:361 (J;US)

ZIRCONIUM FLUORIDES
Application of nuclear reaction analysis to trace oxygen analysis in metal fluoride materials, 15:1857 (J;US)

ZIRCONIUM OXIDES
High-temperature precipitation hardening of Y_2O_3 partially-stabilized ZrO_2 (Y-PSZ) single crystals, 15:840 (J;US)
Metal oxide films from carboxylate precursors, 15:817 (R;US)
[Deposition and interactions of particulates on substrates]: Foreign trip report, September 9, 1988–September 17, 1988, 15:832 (R;US)

ZONES (AURORAL)
See AURORAL ZONES

ZOOPLANKTON
Composition of phytoplankton communities and their contribution to secondary productivity in Carolina Bays on the Savannah River Plant: Year one report, 15:1323 (R;US)

Contract Number Index

Numbers assigned to DOE contracts announced in documents in this publication are listed. Contract numbers are sorted alphanumerically and list the primary corporate author of the document cited, the citation number, and the report number or other document identification.

Contract No.	Abstract No.	Report No.
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	15:243	DOE/FTR–90001320
	15:334	DOE/FTR–90001696
	15:486	DOE/FTR–90001725
	15:731	BNL–42593
	15:760	BNL–43296
	15:769	DOE/FTR–90001293
	15:937	DOE/FTR–90001319
	15:959	DOE/FTR–90002426
	15:1092	DOE/FTR–90001697
	15:1093	DOE/FTR–90001698
	15:1101	BNL–43322
	15:1105	BNL–43335
	15:1106	BNL–43346
	15:1107	BNL–43374
	15:1116	DOE/FTR–90001288
	15:1117	DOE/FTR–90001289
	15:1118	DOE/FTR–90001290
	15:1119	DOE/FTR–90001291
	15:1120	DOE/FTR–90001705
	15:1121	DOE/FTR–90001706
	15:1212	BNL–43250
	15:1366	BNL–52215
	15:1372	DOE/FTR–90001702
	15:1389	DOE/FTR–90001321
	15:1395	DOE/FTR–90001322
	15:1427	DOE/FTR–90001724
	15:1733	BNL–42892
	15:1774	BNL-NCS–43194
	15:1789	BNL–43057
	15:1838	DOE/FTR–90001726
	15:1868	BNL–43198
	Los Alamos National Lab., NM (USA)	
	15:1883	BNL–42852
	15:811	Published article
	15:852	Published article
	15:856	Published article
	15:913	Published article
	15:1759	Published article
	15:1857	Published article
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	15:1122	FNAL-TM–1617
	15:1123	FNAL-TM–1618
	15:1124	FNAL-TM–1619
	15:1163	FNAL-TM–1616
	15:1204	Published article
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	15:1696	PPPL–2654
	15:1885	PPPL–2657
	15:1969	PPPL–2656
	15:1970	PPPL–2658
	15:1749	Published article
AC02-76ER01338	**Missouri Univ., Columbia, MO (USA)**	
	15:1369	DOE/ER/13371–1-Vol.6
	15:1380	Published article
	15:1760	Published article
AC02-76ER13065	**Rochester Univ., NY (USA). Dept. of Physics and Astronomy**	
	15:1764	DOE/ER/13065–589
AC02-78ET51013	**Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center**	
	15:1036	PFC/JA–89-43
	15:1906	PFC/JA–89-37
	Los Alamos National Lab., NM (USA)	
	15:1883	BNL–42852
	15:1217	Published article
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:239	SERI/PR–215-3338
	15:280	CONF-890828–2
	15:693	SERI/SP–220-3220
	15:1378	Published article
AC02-83CH10140	**RE/SPEC, Inc., Rapid City, SD (USA)**	
	15:142	DOE/CH/10378–4
AC02-85ER40236	**Texas A and M Univ., College Station, TX (USA). Dept. of Physics**	
	15:1114	CONF-8810432–1
	15:1760	Published article
AC02-89CH10378	**RE/SPEC, Inc., Rapid City, SD (USA)**	
	15:142	DOE/CH/10378–4
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	15:156	LBL–27428
	15:297	LBL–26612-Vol.3
	15:689	LBL–8678-Rev.3
	15:690	LBL–8688-Rev.5
	15:691	LBL–8706-Suppl.-Rev.5
	15:778	LBL–27249
	15:779	LBL–27377
	15:780	LBL–27378
	15:781	LBL–27563
	15:878	LBL–27661
	15:1096	LBL–27004
	15:1128	LBL–27663
	15:1169	LBL–26321
	15:1214	LBL–26499
	15:1215	LBL–27668
	15:1435	LBL–27638
	15:1436	LBL–27728
	15:1788	LBL–27691
	15:1807	LBL–27617
	15:1989	LBL–27821
	15:803	Published article
	15:843	Published article
	15:867	Published article
	15:1207	Published article
	15:1208	Published article
	15:1464	Published article
	15:1914	Published article
AC03-81ER40050	**California Inst. of Tech., Pasadena, CA (USA)**	
	15:1878	DOE/ER/25009–831
AC03-82ER13000	**Los Alamos National Lab., NM (USA)**	
	15:1873	LA-UR–89-3499
AC03-87DP10560	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	15:1927	DOE/DP/10560–6

Contract No.	Abstract No.	Report No.
AC03-87SF16667	**Architectural Energy Corp., Boulder, CO (USA)**	
	15:685	DOE/SF/16667–T1
AC03-87SF17128	**Connecticut Coll., New London, CT (USA)**	
	15:1028	DOE/SF/17128–T1
AC03-89ER52153	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:1935	EGG-M–89208
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	15:46	SAND–89-0821
	15:170	SAND–87-1246
	15:216	SAND–89-1706C
	15:255	SAND–89-1900C
	15:340	SAND–89-1739C
	15:473	SAND–89-1909C
	15:503	SAND–89-2547C
	15:743	SAND–89-2222C
	15:799	SAND–89-2413C
	15:895	SAND–89-0501
	15:896	SAND–89-2441C
	15:996	SAND–89-2034C
	15:997	SAND–89-2216C
	15:1058	SAND–89-1720
	15:1074	SAND–88-1377
	15:1075	SAND–89-0497
	15:1076	SAND–89-0711C
	15:1211	SAND–89-2539C
	15:1222	SAND–86-0141
	15:1223	SAND–89-2259C
	15:1233	SAND–89-1512C
	15:1697	SAND–89-2191C
	15:1995	SAND–89-1442C
	15:1996	SAND–89-2440C
	15:298	SAND–87-7141
	15:339	SAND–88-7111
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:496	NUREG/CR–5098
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology	
	15:355	NUREG/CR–5079
	15:805	Published article
	15:845	Published article
	15:861	Published article
	15:866	Published article
	15:909	Published article
	15:1077	Published article
	15:1546	Published article
	15:1707	Published article
	15:1708	Published article
	15:1859	Published article
	15:1860	Published article
AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
	15:169	RFP–4352
AC04-76DR00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	15:996	SAND–89-2034C
	Sandia National Labs., Livermore, CA (USA)	
	15:33	SAND–89-8250
	15:1216	SAND–89-8251
AC05-84OR21400	**Oak Ridge National Lab., TN (USA)**	
	15:10	ORNL/FTR–2908
	15:63	ORNL–6569
	15:78	ORNL–6570
	15:118	CONF-891103–25
	15:119	CONF-891103–26
	15:120	CONF-891118–8
	15:125	CONF-891103–20
	15:140	CONF-891020–1
	15:141	CONF-891103–21
	15:165	ORNL/TM–11286
	15:338	ORNL–6573
	15:382	ORNL/FTR–2933
	15:383	ORNL/FTR–2941
	15:384	ORNL/FTR–3176
	15:385	ORNL/FTR–3186
	15:386	ORNL/tr–89/43
	15:387	ORNL/tr–89/44
	15:388	ORNL/tr–89/45
	15:422	CONF-891103–18
	15:423	CONF-891118–4
	15:427	ORNL/tr–89/41
	15:477	ORNL/TM–11309
	15:482	CONF-880913–9
	15:483	CONF-891027–3
	15:484	CONF-891027–4
	15:485	CONF-891140–1
	15:499	ORNL/TM–11311
	15:588	CONF-8910162–4
	15:616	CONF-8910235–1
	15:653	ORNL/CON–289
	15:696	ORNL–6565
	15:732	ORNL/M–966
	15:765	CONF-891119–1
	15:787	ORNL/FTR–2972
	15:788	ORNL/FTR–3068
	15:789	ORNL/FTR–3180
	15:790	ORNL/FTR–3245
	15:791	ORNL/FTR–3379
	15:792	ORNL/FTR–3397
	15:793	ORNL/FTR–3400
	15:794	ORNL/FTR–3418
	15:824	CONF-891116–1
	15:831	ORNL/FTR–2954
	15:832	ORNL/FTR–3066
	15:833	ORNL/FTR–3096
	15:834	ORNL/FTR–3097
	15:835	ORNL/FTR–3156
	15:871	CONF-891091–2
	15:874	CONF-8911100–1
	15:887	ORNL/tr–89-47
	15:917	CONF-891013–5
	15:986	CONF-891118–3
	15:991	ORNL/TM–11318
	15:1034	ORNL/FTR–3416
	15:1072	CAPE–3016
	15:1113	CONF-891055–1
	15:1160	CONF-891087–6
	15:1174	ORNL/FTR–3090
	15:1175	ORNL/FTR–3405
	15:1239	ORNL/CDIAC–27
	15:1257	CONF-8909243–1
	15:1261	ORNL/FTR–3403
	15:1262	ORNL/TM–11214
	15:1285	ORNL/FTR–3402
	15:1296	CONF-891057–2
	15:1299	ORNL–6526/R7
	15:1300	ORNL–6526/R8
	15:1301	ORNL/FTR–3411
	15:1302	ORNL/TM–11294
	15:1308	ORNL/RASA–87/32
	15:1309	ORNL/RASA–87/33
	15:1310	ORNL/RASA–87/35
	15:1311	ORNL/RASA–88/25
	15:1312	ORNL/RASA–88/39
	15:1313	ORNL/RASA–88/51
	15:1314	ORNL/RASA–88/55
	15:1315	ORNL/RASA–88/56
	15:1316	ORNL/RASA–88/58
	15:1368	CONF-8905235–1

Contract No.	Abstract No.	Report No.
	15:1416	ORNL/FTR–3398
	15:1422	CONF-891103–11
	15:1423	CONF-8804141–9
	15:1442	ORNL/M–785
	15:1443	ORNL/TM–11194
	15:1466	CONF-8908108–3
	15:1468	CONF-8810116–Summ.
	15:1780	CONF-8910237–2
	15:1848	CONF-881155–44
	15:1849	CONF-891117–9
	15:1850	CONF-8804141–
	15:1853	ORNL/FTR–3422
	15:1870	CONF-890971–5
	15:1874	ORNL/FTR–3067
	15:1888	CONF-891007–22
	15:1889	CONF-891007–24
	15:1890	CONF-8909238–1
	15:1919	CONF-891007–73
	15:1920	CONF-891103–24
	15:1923	CONF-8910225–2
	15:1924	CONF-8910225–3
	15:1925	CONF-8910225–4
	15:1926	CONF-8910225–5
	15:1963	ORNL/FTR–2918
	15:1964	ORNL/FTR–2920
	15:1965	ORNL/FTR–2950
	15:1966	ORNL/FTR–3010
	15:1967	ORNL/FTR–3031
	15:1968	ORNL/FTR–3421
	15:1983	CONF-891113–4
	15:1987	CONF-8910246–1
	15:1991	ORNL/FTR–3406
	15:2011	CONF-8909188–1
	15:163	ORNL/Sub–86-SA094/3
	15:305	ORNL/Sub–85-27488/04
	15:332	ORNL/Sub–85-22012/1
	15:716	ORNL/Sub–87-SB064/1
	15:836	ORNL/Sub–86-57444/01
	Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research	
	15:159	NUREG/CP–0098-Vol.1
	Los Alamos National Lab., NM (USA)	
	15:1797	CONF-891103–19
	Environmental Consulting Engineers, Inc., Knoxville, TN (USA)	
	15:164	ORNL/Sub–88-SC924/1
	Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.	
	15:213	K/ITP–192
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	15:356	NUREG/CR–5365
	15:1973	CONF-870457–
	15:1742	CONF-8806236–
	15:812	Published article
	15:844	Published article
	15:948	Published article
	15:1206	Published article
	15:1306	Published article
	15:1795	Published article
	15:1822	Published article
AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
	15:1001	Y/DX–878
	15:1706	Published article
AC06-76RL01830	**Hanford Works, Richland, WA (USA)**	
	15:1431	HW–26471
	Battelle Pacific Northwest Lab., Richland, WA (USA)	
	15:134	BNWL-CC–2188
	15:135	BNWL-CC–2378
	Electric Power Research Inst., Palo Alto, CA (USA)	
	15:471	EPRI-NP–6551
	Pacific Northwest Lab., Richland, WA (USA)	
	15:128	PNL–6838
	15:166	PNL–6992
	15:167	PNL-SA–16955
	15:168	PNL-SA–17002
	15:254	PNL–7126
	15:357	PNL-SA–17065
	15:500	PNL-SA–17354
	15:654	PNL-SA–16957
	15:798	PNL-SA–16212
	15:1303	PNL–6930
	15:1341	PNL-SA–16897
	15:1245	Published article
	15:1246	Published article
	15:1247	Published article
AC06-84RL10421	**Westinghouse Hanford Co., Shippingport, PA (USA). Shippingport Station Decommissioning Project Office**	
	15:487	DOE/SSDP–0082
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:114	WHC-SA–0548
	15:115	WHC-SA–0603
	15:173	WHC-SA–0661
	15:174	WHC-SA–0718
	15:452	WHC-SA–0663
	15:458	WHC-SA–0639
	15:478	WHC-SA–0730
	15:505	WHC-SA–0753
	15:1304	WHC-SP–0193
	15:1319	WHC-SA–0606
	15:147	DOE/RL–89-13
	Department of Energy, Richland, WA (USA). Richland Operations Office	
	15:145	DOE/RL–88-27-Add.1
	USDOE Richland Operations Office, WA (USA)	
	15:146	DOE/RL–88-27-Suppl.1
	Westinghouse Hanford Co., Shippingport, PA (USA). Shippingport Station Decommissioning Project Office	
	15:203	DOE/SSDP–0053
	15:487	DOE/SSDP–0082
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:7	EGG-M–89235
	15:8	EGG-M–89237
	15:21	EGG-M–89181
	15:104	EGG-M–88320
	15:111	EGG-M–88287
	15:148	EGG-M–88389
	15:149	EGG-M–88435
	15:234	DOE/ID–10237
	15:296	EGG-M–88242
	15:490	EGG-M–89256
	15:549	EGG-EP–8656
	15:825	EGG-MS–8696
	15:987	EGG-M–89303
	15:1282	EGG-ESE–8600
	15:1298	EGG-ER–8623
	15:1318	EGG-M–89063
	15:1428	EGG-BNCT–8353-Vol.3-No.5
	15:1429	EGG-BNCT–8353-Vol.3-No.6

Contract No.	Abstract No.	Report No.
	15:1430	EGG-BNCT–8353-Vol.3-No.7
	15:1543	EGG-BEG–8665
	15:1839	EGG-M–00688
	15:1884	EGG-M–89099
	15:1929	EGG-FSP–8678
	15:1930	EGG-FSP–8709
	15:1931	EGG-M–88267
	15:1932	EGG-M–89202
	15:1933	EGG-M–89204
	15:1934	EGG-M–89206
	15:1935	EGG-M–89208
	15:1936	EGG-M–89213
	15:1937	EGG-M–89214
	15:1938	EGG-M–89216
	15:1939	EGG-M–89239
	15:1940	EGG-M–89279
	15:489	EGG-M–89187
	General Atomics Co., San Diego, CA (USA)	
	15:126	GA-A–19701
AC07-82ID12356	**Acres International Corp., Amherst, NY (USA)**	
	15:235	DOE/ID/12356–1
AC07-82ID12422	**Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center**	
	15:700	DOE/ID/12422–2
AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA)**	
	15:175	WINCO–1068
	15:1320	WINCO–1069
	American Nuclear Society (USA). Fuel Cycle and Waste Management Div.	
	15:136	CONF-860905–Vol.2
AC07-84ID12553	**National Food Processors Association, Dublin, CA (USA)**	
	15:701	DOE/ID/12553–3
AC07-86ID12584	**UNC Geotech, Grand Junction, CO (USA). Technical Measurements Center**	
	15:684	DOE/ID/12584–44
AC07-88ID12698	**General Atomics Co., San Diego, CA (USA)**	
	15:126	GA-A–19701
AC08-89NV10630	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)**	
	15:1229	CONF-8910241–1
AC09-89SR18035	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA)**	
	15:919	DPT–132
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	15:121	DPST–89-348
	Ministry of Nuclear Industry, Taiyuan, SX (China). Inst. of Radiation Protection	
	15:488	DPT–128
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	15:176	WSRC-RP–89-511
	15:177	WSRC-RP–89-659-Rev.1
	15:178	WSRC-RP–89-740
	15:480	WSRC-RP–89-385
	15:506	WSRC-RP–89-25
	15:507	WSRC-RP–89-376
	15:897	WSRC-RP–89-386
	15:967	WSRC-RP–89-77
	15:1000	WSRC-RP–89-518
	15:1286	WSRC-RP–89-388
	15:1305	WSRC-RP–89-822
AC21-85FC10628	**Brigham Young Univ., Provo, UT (USA). Combustion Lab.**	
	15:20	DOE/FC/10628–2712-Vol.1
AC21-85MC22042	**Stanford Univ., CA (USA). Dept. of Petroleum Engineering**	
	15:52	DOE/MC/22042–15
AC21-87MC23270	**International Fuel Cells Corp., South Windsor, CT (USA)**	
	15:657	DOE/MC/23270–2751
AC21-87MC23288	**City Coll., New York, NY (USA)**	
	15:4	DOE/MC/23288–2742
AC22-85BC10845	**Oklahoma Univ., Norman, OK (USA). School of Chemical Engineering and Materials Science**	
	15:50	DOE/BC/10845–15
AC22-85BC10847	**Illinois Inst. of Tech., Chicago, IL (USA)**	
	15:51	DOE/BC/10847–15
AC22-88PC88653	**Solmecs Ltd., Jerusalem (Israel)**	
	15:655	DOE/PC/88653–T1
AI01-87CE34011	**National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Electronics and Electrical Engineering**	
	15:331	NISTIR–89-4167
AI08-78ET44802	**Colorado Geological Survey, Denver, CO (USA)**	
	15:172	USGS-OFR–89-359
	15:1729	Published article
	15:1729	Published article
AS05-80ER10713	**Virginia Polytechnic Inst., Blacksburg, VA (USA). Dept. of Physics**	
	15:1763	CONF-8907140–2
	15:1741	Published article
	15:1771	Published article
	15:1751	Published article
FC06-87RL11396	**Alaska Univ., Fairbanks, AK (USA). Inst. of Northern Engineering**	
	15:1414	DOE/RL/11396–1
	15:1415	DOE/RL/11396–T1
FC09-88SR15199	**South Carolina Univ., Columbia, SC (USA). Savannah River Archaeological Research Program**	
	15:1362	DOE/SR/15199–2
FC21-87MC24207	**West Virginia Univ., Morgantown, WV (USA). Energy and Water Research Center**	
	15:30	DOE/MC/24207–2748
FG01-87ER60505	**World Wildlife Fund, Washington, DC (USA)**	
	15:1253	CONF-881097–1
FG01-88CE27489	**American Council for an Energy-Efficient Economy, Washington, DC (USA)**	
	15:633	CONF-8808273–Vol.3
	15:634	CONF-8808273–Vol.5
	15:635	CONF-8808273–Vol.11
	15:676	CONF-8808273–Suppl.
	15:677	CONF-8808273–Vol.1
	15:678	CONF-8808273–Vol.2
	15:679	CONF-8808273–Vol.4
	15:680	CONF-8808273–Vol.6
	15:681	CONF-8808273–Vol.8
	15:682	CONF-8808273–Vol.9
	15:683	CONF-8808273–Vol.10
FG02-85ER13427	**Yale Univ., New Haven, CT (USA). Dept. of Mechanical Engineering**	
	15:972	DOE/ER/13427–2
FG02-85ER13454	**Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry**	
	15:936	DOE/ER/13454–T4
FG02-85ER40231	**Syracuse Univ., NY (USA)**	
	15:1765	DOE/ER/40231–T6
	Syracuse Univ., NY (USA). Dept. of Physics	
	15:1766	DOE/ER/40231–T7

Contract No.	Abstract No.	Report No.
FG02-85ER45190	**Harvard Univ., Cambridge, MA (USA)**	
	15:1692	DOE/ER/45190–2
FG02-85ER53212	**Wisconsin Univ., Madison, WI (USA)**	
	15:1891	DOE/ER/53212–144
FG02-86ER45231	**State Univ. of New York, Buffalo, NY (USA). Dept. of Chemistry**	
	15:1851	DOE/ER/45231–4
FG02-86ER52127	**Illinois Univ., Urbana, IL (USA)**	
	15:1921	CONF-8905224–1
FG02-87ER13696	**Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering**	
	15:1985	CONF-8811259–1
	15:1382	Published article
	15:1407	Published article
FG02-87ER60524	**Michigan State Univ., East Lansing, MI (USA)**	
	15:1441	DOE/ER/60524–2
FG02-87ER60539	**New York Univ., NY (USA). Dept. of Environmental Medicine**	
	15:1425	DOE/ER/60539–T2
	15:1856	Published article
FG02-88ER53264	**Wisconsin Univ., Madison, WI (USA). Dept. of Nuclear Engineering and Engineering Physics**	
	15:1928	DOE/ER/53264–2
FG02-88ER60636	**Johns Hopkins Univ., Baltimore, MD (USA)**	
	15:1426	DOE/ER/60636–T1
	New York Univ., NY (USA)	
	15:1370	DOE/ER/60636–T3
FG02-88ER60674	**New York Univ., NY (USA). Dept. of Chemistry**	
	15:1371	DOE/ER/60674–2
FG03-85ER13334	**California Univ., Riverside, CA (USA)**	
	15:240	CONF-8501124–
	15:1367	CONF-8601154–
FG03-85ER25009	**California Inst. of Tech., Pasadena, CA (USA)**	
	15:1878	DOE/ER/25009–831
	15:1875	Published article
	15:1383	Published article
FG05-83OR21389	**CONEG Policy Research Center, Inc., Washington, DC (USA)**	
	15:231	DOE/OR/21389–22
	Biomass Energy Service Team, Falmouth, ME (USA)	
	15:244	DOE/OR/21389–23
FG05-86ER13574	**Florida Univ., Gainesville, FL (USA)**	
	15:242	DOE/ER/13574–1
	15:1747	Published article
FG05-88CE40835	**American Paper Inst., Inc., New York, NY (USA)**	
	15:699	DOE/CE/40835–T1
FG05-88ER13834	**Tennessee Univ., Knoxville, TN (USA). Dept. of Physics**	
	15:768	DOE/ER/13834–8
FG05-88ER13881	**Florida Univ., Gainesville, FL (USA). Dept. of Chemistry**	
	15:918	DOE/ER/13881–2
	15:949	CONF-880606–
	15:1783	Published article
	15:1729	Published article
FG05-88ER53266	**Texas Univ., Austin, TX (USA). Fusion Research Center**	
	15:1893	DOE/ER/53266–16
FG05-88ER60686	**American Type Culture Collection, Rockville, MD (USA)**	
	15:1391	DOE/ER/60686–1
FG05-89ER45384	**North Carolina State Univ., Raleigh, NC (USA)**	
	15:1146	DOE/ER/45384–1
FG05-89OR21864	**Saint Charles County Water Dept., St. Charles, MO (USA)**	
	15:144	DOE/OR/21864–2
FG06-86ER60409	**Washington Univ., Seattle, WA (USA). Dept. of Biological Structure**	
	15:1424	DOE/ER/60409–4
FG06-87ER53242	**Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program**	
	15:1892	DOE/ER/53242–3
FG06-88ER40402	**Oregon State Univ., Corvallis, OR (USA)**	
	15:1794	DOE/ER/40402–2
FG09-88SR18049	**South Carolina State Coll., Orangeburg, SC (USA). Dept. of Natural Sciences**	
	15:1323	DOE/SR/18049–1
FG21-85LC11066	**Alabama Univ., University, AL (USA). School of Mines and Energy Development**	
	15:105	DOE/LC/11066–2719-Vol.2
	15:106	DOE/LC/11066–2719-Vol.3
FG22-84PC71257	**Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering**	
	15:5	DOE/PC/71257–T18
FG22-86PC90533	**Brigham Young Univ., Provo, UT (USA)**	
	15:6	DOE/PC/90533–9
FG22-89BC14403	**Texas Office of the Governor, Austin, TX (USA)**	
	15:47	DOE/BC/14403–2
W-31-109-ENG-38	**Electric Power Research Inst., Palo Alto, CA (USA)**	
	15:550	EPRI-AP–6012-SR
	15:848	Published article
	15:849	Published article
	15:854	Published article
	15:859	Published article
	15:862	Published article
	15:864	Published article
	15:1377	Published article
	15:1408	Published article
	15:1876	Published article
W-31109-ENG-38	**Argonne National Lab., Idaho Falls, ID (USA)**	
	15:113	CONF-891103–36
	Argonne National Lab., IL (USA)	
	15:17	CONF-890902–17
	15:18	CONF-890902–18
	15:19	CONF-891001–8
	15:24	CONF-891046–2
	15:29	CONF-891130–1
	15:138	CONF-890488–12
	15:139	CONF-890488–13
	15:241	CONF-8908164–1
	15:279	CONF-8909128–4
	15:300	CONF-891046–3
	15:335	CONF-8909235–2
	15:390	CONF-890855–59
	15:391	CONF-891103–2
	15:392	CONF-891103–35
	15:393	CONF-891140–2
	15:475	CONF-8909141–2
	15:698	CONF-890814–8
	15:745	CONF-8909219–2
	15:762	CONF-890771–5
	15:763	CONF-890820–5
	15:764	CONF-891117–5
	15:766	CONF-8906112–3
	15:767	CONF-8907114–3
	15:819	CONF-890468–13
	15:820	CONF-890468–14
	15:821	CONF-890480–3
	15:822	CONF-890971–3
	15:823	CONF-890971–4

Contract No.	Abstract No.	Report No.
	15:870	CONF-890953–8
	15:872	CONF-891119–3
	15:873	CONF-891120–3
	15:958	CONF-891119–2
	15:1051	CONF-8906112–
	15:1090	CONF-8905190–1
	15:1109	CONF-890335–262
	15:1110	CONF-890335–263
	15:1111	CONF-890335–270
	15:1112	CONF-890703–20
	15:1115	CONF-8908145–3
	15:1141	CONF-890335–260
	15:1142	CONF-890335–261
	15:1143	CONF-890335–265
	15:1144	CONF-890335–266
	15:1145	CONF-890335–268
	15:1153	ANL-HEP-CP–89-52
	15:1161	CONF-8909218–1
	15:1254	CONF-890526–2
	15:1255	CONF-890563–3
	15:1256	CONF-890692–23
	15:1297	CONF-8909232–1
	15:1317	CONF-8904232–2
	15:1327	CONF-8909170–2
	15:1345	CONF-891013–4
	15:1719	ANL-HEP-CP–89-53
	15:1720	ANL-HEP-CP–89-60
	15:1721	ANL-HEP-CP–89-102
	15:1730	ANL-HEP-CP–89-87
	15:1731	ANL-HEP-CP–89-104
	15:1732	ANL-HEP-CP–89-107
	15:1762	ANL-HEP-CP–89-55
	15:1779	CONF-890875–2
	15:1799	CONF-890902–19
	15:1828	CONF-890798–13
	15:1829	CONF-8905231–1
	15:1869	CONF-890335–269
	15:1918	CONF-890982–4
	15:1922	CONF-8909234–1
	15:1984	CONF-891149–8
	15:1986	CONF-8909231–1
	15:1729	Published article
W-7405-ENG-36	**Argonne National Lab., IL (USA)**	
	15:1918	CONF-890982–4
	Los Alamos National Lab., NM (USA)	
	15:151	LA-UR–89-2017
	15:152	LA-UR–89-2032
	15:153	LA-UR–89-2124
	15:154	LA-UR–89-3116
	15:155	LA-UR–89-3210
	15:214	LA-UR–89-2046
	15:215	LA-UR–89-3171
	15:293	LA–11550-MS
	15:294	LA–11510-MS-Pt.2
	15:457	LA-UR–89-2418
	15:777	LA-UR–89-3135
	15:827	LA–11592-T
	15:875	LA-UR–89-3001
	15:876	LA-UR–89-3002
	15:877	LA-UR–89-3301
	15:1030	LA-UR–89-3486
	15:1073	LA–11633-MS
	15:1095	LA-UR–89-3111
	15:1126	LA-UR–89-3534
	15:1127	LA-UR–89-3596
	15:1148	LA-UR–89-3560
	15:1167	LA–11659-M
	15:1221	LA-UR–89-3000
	15:1284	LA–11672-PR
	15:1373	LA-UR–89-3232
	15:1402	LA-UR–89-3265
	15:1568	LA-UR–89-3124
	15:1569	LA-UR–89-3310
	15:1693	LA–11677-MS
	15:1737	LA-UR–89-3426
	15:1738	LA-UR–89-3609
	15:1776	LA-UR–89-2210
	15:1798	LA-UR–89-2207
	15:1805	LA–11701-MS
	15:1806	LA-UR–89-2209
	15:1852	LA-UR–89-3008
	15:1872	LA-UR–89-3336
	15:1873	LA-UR–89-3499
	15:1880	LA-UR–89-3576
	15:1901	LA-UR–89-3327
	15:1943	LA-UR–89-2913
	15:1944	LA-UR–89-3043
	15:1945	LA-UR–89-3233
	15:1946	LA-UR–89-3261
	15:1947	LA-UR–89-3262
	15:1948	LA-UR–89-3271
	15:1949	LA-UR–89-3276
	15:1950	LA-UR–89-3279
	15:1951	LA-UR–89-3280
	15:1952	LA-UR–89-3281
	15:1953	LA-UR–89-3291
	15:1954	LA-UR–89-3293
	15:1955	LA-UR–89-3298
	15:1956	LA-UR–89-3299
	15:1957	LA-UR–89-3322
	15:1958	LA-UR–89-3352
	15:1959	LA-UR–89-3353
	15:1960	LA-UR–89-3382
	15:1961	LA-UR–89-3383
	15:1962	LA-UR–89-3482
	15:1988	LA-UR–89-2607
	15:1797	CONF-891103–19
	15:1207	Published article
W-7405-ENG-48	**Lawrence Livermore National Lab., CA (USA)**	
	15:107	UCRL–101859
	15:171	UCRL–102033
	15:217	UCRL–101305
	15:230	UCRL–101953
	15:504	UCRL–101842
	15:631	UCRL–52000-89-9
	15:727	UCRL–101995
	15:800	UCRL–100833
	15:837	UCRL–100792
	15:947	UCRL–101908
	15:998	UCRL–100272
	15:999	UCRL–101399
	15:1059	UCID–21800
	15:1067	UCRL–101903
	15:1102	UCID–21791-1
	15:1129	UCRL–101299
	15:1228	CONF-8909163–Absts.
	15:1230	UCID–21758
	15:1232	UCRL–101706
	15:1234	UCRL–101542-Rev.1
	15:1280	UCRL–101736
	15:1437	UCRL–101507
	15:1544	UCRL–98727
	15:1603	UCRL–101115
	15:1604	UCRL–101924
	15:1698	UCRL–100904
	15:1791	UCRL–101174
	15:1881	UCRL–101302
	15:1907	UCRL–100498
	15:1908	UCRL–101947
	15:1971	UCRL–101063
	15:1972	UCRL–102100
	15:1977	UCRL–101695
	15:1997	UCRL–100735

Contract No.	Abstract No.	Report No.
	15:1998	UCRL–101437
	15:1231	UCRL–21226
	15:1279	UCRL–21214-Vol.4
	15:806	Published article
	15:853	Published article
	15:1207	Published article
	15:1219	Published article
	15:1244	Published article
	15:1249	Published article
	15:1711	Published article
	15:1713	Published article
	15:1916	Published article
W-7405-ENG-82	**Brookhaven National Lab., Upton, NY (USA)**	
	15:1789	BNL–43057
	15:841	Published article
	15:846	Published article
	15:953	Published article

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
ACTC–					
89-03-01	15:817	*See* AD-A–210149/1/XAB			
AD-A–					
201266/4/XAB	15:1615	NTIS, PC A03/MF A01			
204210/9/XAB	15:1978	NTIS, PC A03/MF A01			
204788/4/XAB	15:68	NTIS, PC A15/MF A01			
204895/7/XAB	15:1100	NTIS, PC A02/MF A01			
205014/4/XAB	15:1018	NTIS, PC A03/MF A01			
205136/5/XAB	15:1325	NTIS, PC A06/MF A01			
205143/1/XAB	15:1440	NTIS, PC A03/MF A01			
205194/4/XAB	15:1547	NTIS, PC A03/MF A01			
205209/0/XAB	15:1326	NTIS, PC A12/MF A01			
205210/8/XAB	15:1616	NTIS, PC A03/MF A01			
206915/1/XAB	15:1887	NTIS, PC A03/MF A01			
207450/8/XAB	15:1224	NTIS, PC A14/MF A01			
209108/0/XAB	15:979	NTIS, PC A03/MF A01			
209307/8/XAB	15:1393	NTIS, PC A06/MF A01			
209617/0/XAB	15:730	NTIS, PC A04/MF A01			
209626/1/XAB	15:1019	NTIS, PC A02/MF A01			
209627/9/XAB	15:1020	NTIS, PC A02/MF A01			
209645/1/XAB	15:1068	NTIS, PC A05/MF A01			
209653/5/XAB	15:1021	NTIS, PC A03/MF A01			
209663/4/XAB	15:1417	NTIS, PC A02/MF A01			
209665/9/XAB	15:1691	NTIS, PC A02/MF A01			
209674/1/XAB	15:749	NTIS, PC A03/MF A01			
209675/8/XAB	15:1322	NTIS, PC A06/MF A01			
209676/6/XAB	15:1363	NTIS, PC A17/MF A01			
209696/4/XAB	15:751	NTIS, PC A03/MF A01			
209720/2/XAB	15:1149	NTIS, PC A03/MF A01			
209721/0/XAB	15:1150	NTIS, PC A03/MF A01			
209722/8/XAB	15:1151	NTIS, PC A03/MF A01			
209723/6/XAB	15:1152	NTIS, PC A03/MF A01			
209740/0/XAB	15:1022	NTIS, PC A03/MF A01			
209767/3/XAB	15:45	NTIS, PC A04/MF A01			
209770/7/XAB	15:816	NTIS, PC A03/MF A01			
209773/1/XAB	15:2	NTIS, PC A04/MF A01			
209777/2/XAB	15:2012	NTIS, PC A03/MF A01			
209785/5/XAB	15:1251	NTIS, PC A07/MF A01			
209791/3/XAB	15:1252	NTIS, PC A03/MF A01			
209795/4/XAB	15:1225	NTIS, PC A03/MF A01			
209802/8/XAB	15:1023	NTIS, PC A07/MF A01			
209803/6/XAB	15:1541	NTIS, PC A03/MF A01			
209811/9/XAB	15:750	NTIS, PC A04/MF A01			
209822/6/XAB	15:1877	NTIS, PC A02/MF A01			
209847/3/XAB	15:1024	NTIS, PC A08/MF A01			
209870/5/XAB	15:1025	NTIS, PC A02/MF A01			
209875/4/XAB	15:980	NTIS, PC A04/MF A01			
209901/8/XAB	15:1979	NTIS, PC A03/MF A01			
209902/6/XAB	15:1418	NTIS, PC A03/MF A01			
209913/3/XAB	15:1026	NTIS, PC A03/MF A01			
209934/9/XAB	15:752	NTIS, PC A07/MF A01			
209936/4/XAB	15:1069	NTIS, PC A02/MF A01			
209941/4/XAB	15:1062	NTIS, PC A04/MF A01			
209944/8/XAB	15:1070	NTIS, PC A03/MF A01			
209948/9/XAB	15:753	NTIS, PC A02/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
209951/3/XAB	15:981	NTIS, PC A02/MF A01			
209954/7/XAB	15:1617	NTIS, PC A04/MF A01			
209960/4/XAB	15:982	NTIS, PC A02/MF A01			
209965/3/XAB	15:983	NTIS, PC A02/MF A01			
209969/5/XAB	15:1071	NTIS, PC A05/MF A01			
209981/0/XAB	15:1542	NTIS, PC A05/MF A01			
209993/5/XAB	15:1618	NTIS, PC A03/MF A01			
209998/4/XAB	15:1027	NTIS, PC A04/MF A01			
210014/7/XAB	15:1394	NTIS, PC A03/MF A01			
210023/8/XAB	15:626	NTIS, PC A03/MF A01			
210024/6/XAB	15:548	NTIS, PC A03/MF A01			
210072/5/XAB	15:1226	NTIS, PC A04/MF A01			
210074/1/XAB	15:3	NTIS, PC A07/MF A01			
210075/8/XAB	15:984	NTIS, PC A02/MF A01			
210107/9/XAB	15:1227	NTIS, PC A05/MF A01			
210109/5/XAB	15:1548	NTIS, PC A06/MF A01			
210134/3/XAB	15:754	NTIS, PC A04/MF A01			
210149/1/XAB	15:817	NTIS, PC A03/MF A01			
210165/7/XAB	15:1210	NTIS, PC A08/MF A01			
210176/4/XAB	15:1980	NTIS, PC A02/MF A01			
955540/0/XAB	15:1390	NTIS, PC A02/MF A01			
955551/7/XAB	15:1619	NTIS, PC A03/MF A01			
AFAL-TR–					
89-006	15:1887	*See* AD-A–206915/1/XAB			
AFIT/GNE/ENP–					
89J-1	15:1393	*See* AD-A–209307/8/XAB			
AGARD-CP–					
437-VOL-1	15:1048	NTIS, PC A25/MF A01			
437-VOL-2	15:1049	NTIS, PC A11/MF A01			
449	15:756	NTIS, PC A13/MF A01			
AIAA–					
89-1744	15:1053	*See* N–89-23818			
AIAA-Paper–					
89-2711;CONF-8907118–	15:1002				
ANL-HEP-CP–					
89-102	15:1721	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001438	MF-414
89-104	15:1731	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001417	MF-414
89-107	15:1732	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002207	MF-414
89-52	15:1153	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002267	MF-413
89-53	15:1719	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002250	MF-414
89-55	15:1762	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001987	MF-414
89-60	15:1720	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002277	MF-414
89-87	15:1730	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002212	MF-414
APL-UW-TR–					
8822	15:1322	*See* AD-A–209675/8/XAB			
ATR–					
88(8359)-5	15:869	NTIS, PC A03/MF A01			
BAW–					
2061-Vol.3	15:497	*See* NUREG/CR–5395-Vol.3			
2064	15:498	*See* NUREG/CR–5395-Vol.5			
BLM/AZ/PT–					
89/009/8500	15:623	*See* PB–89-214878/XAB			
BLM/NM/PT–					
89/009/4410	15:1365	*See* PB–89-214951/XAB			
BMU–					
1988-198	15:1307	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1989-214	15:481	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1989-224/1	15:117	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
BMVg-FBWM–					
89-1	15:1419	Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw)			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-2	15:1420	Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw)			
89-7	15:1421	Available from Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentations- und Fachinformationszentrum der Bundeswehr (DOKFIZBw)			
BNL–					
42593	15:731	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000530	MF-109
42852	15:1883	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001330	MF-414
42892	15:1733	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015074	MF-414
43057	15:1789	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002588	MF-413
43198	15:1868	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002457	MF-414
43250	15:1212	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001269	MF-401; MF-414
43296	15:760	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001271	MF-404
43322	15:1101	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002311	MF-414
43335	15:1105	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001548	MF-406
43346	15:1106	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002290	MF-414
43374	15:1107	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002291	MF-406
52215	15:1366	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001777	PC-408
BNL-NCS–					
43194	15:1774	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000108	MF-413
BNWL-CC–					
2188	15:134	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001661	MF-711
2378	15:135	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001660	MF-711
BONN-IR–					
88-55	15:1722	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-07	15:1723	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-09	15:1981	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-18	15:1154	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-19	15:1155	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-20	15:1156	NTIS (US Sales Only), PC A04/MF A01		DE90718237	
89-21	15:1157	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-22	15:1158	NTIS (US Sales Only), PC A04/MF A01		DE90718238	
89-23	15:1159	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
89-26	15:1108	NTIS (US Sales Only), PC A04/MF A01		DE90718234	
BRE-IP–					
1/89	15:673	Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR			
2/89	15:674	Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR			
22/88	15:675	Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR			
BUMINES-OFR–					
15-89	15:622	*See* PB–89-214217/XAB			
BUMINES-RI–					
9232	15:933	*See* PB–89-201404/XAB			
BfG–					
0447	15:1344	NTIS (US Sales Only), PC A05/MF A01		DE90717904	
CAPE–					
3016	15:1072	OSTI		TI90000073	ND-406
CBIAC–					
88-113	15:1224	*See* AD-A–207450/8/XAB			
CEA-CONF–					
9775	15:220	NTIS (US Sales Only), PC A03/MF A01		DE90713878	
CEGB-TPRD/L–					
3261/R88	15:761	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90606331	
CENBG–					
88-23	15:1785	NTIS (US Sales Only), PC A02/MF A01		DE90713788	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-521001–		(Health physics conference; Idaho Falls, ID (USA); 16-18 Oct 1952)			
Summ.	15:1431	*See* HW–26471			
CONF-8110302–		(2. seminar on physical metallurgy and heat treatments; Rio de Janeiro (Brazil); 1-2 Oct 1981)			
	15:927	*See* INIS-BR–1658			
CONF-8212117–		(1. meeting of Southern Hemisphere on mineral technology and 9th national meeting on mineral treatment and hydrometallurgy; Rio de Janeiro (Brazil); 5-10 Dec 1982)			
	15:112	*See* INIS-BR–1659			
	15:940	*See* INIS-BR–1660			
CONF-8310455–		(26. Brazilian Congress of Chemistry; Sao Paulo (Brazil); 10-15 Oct 1983)			
	15:926	*See* INIS-BR–1657			
CONF-8501124–		(8. annual symposium in plant physiology: regulation of carbon partitioning in photosynthetic tissue; Riverside, CA (USA); 11-12 Jan 1985)			
	15:240	American Society of Plant Physiologists, 15501-A Monona Drive, Rockville, MD 20855			ND-408
CONF-8601154–		(9. annual symposium in plant physiology: molecular biology of seed storage proteins and lectins; Riverside, CA (USA); 9-11 Jan 1986)			
	15:1367	American Society of Plant Physiologists, 15501-A Monona Drive, Rockville, MD 20855			ND-408
CONF-8610464–		(5. international symposium on radiopharmacology; Buenos Aires (Argentina); 29-31 Oct 1986)			
	15:961	*See* INIS-mf–11544			
CONF-870457–		(Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies; Pleasanton, CA (USA); 8-9 Apr 1987)			
	15:1912				
	15:1973				
	15:1974				
CONF-870602–		(194. American Chemical Society national meeting; New Orleans, LA (USA); 30 Aug - 4 sep 1987)			
	15:23				
CONF-870902–		(ICBEM '87: international congress on building energy management; Lausanne (Switzerland); 28 Sep - 2 oct 1987)			
4	15:281	*See* ETDE-IT–89-03			
CONF-8710500–		(Seminar on reducing power plant emissions by controlling coal quality; Bethesda, MD (USA); 27-28 Oct 1987)			
	15:310	*See* EPRI-GS–6281			
CONF-880314–		(Corrosion '88: National Association of Corrosion Engineers meeting; St. Louis, MO (USA); 21-25 Mar 1988)			
	15:801	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218			
CONF-880348–		(American Institute of Chemical Engineers spring national meeting; New Orleans, LA (USA); 6-10 Mar 1988)			
	15:34	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:62	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:88	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:180	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
CONF-880404–		(7. international congress of the International Radiation Protection Association (IRPA); Sydney (Australia); 10-17 Apr 1988)			
21	15:1839	*See* EGG-M–00688			
CONF-8804141–		(11. Werner Brandt workshop on charged particle penetration phenomena; Oak Ridge, TN (USA); 14-15 Apr 1988)			
	15:1850	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000959	MF-410
9	15:1423	NTIS, PC A02/MF A01 - OSTI		DE90000573	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8805159–		(22. annual conference on trace substances in environmental health; St. Louis, MO (USA); 23-26 May 1988)			
	15:1342				
CONF-8805212–					
	15:776	*See* LAPP-EXP–88-09			
	15:1726	*See* LAPP-EXP–88-11			
CONF-8805302–		(Conference on validation of computational fluid dynamics; Lisbon (Portugal); 2 May 1988)			
	15:1048	*See* AGARD-CP–437-VOL-1			
CONF-880532–		(American Nuclear Society topical meeting; Seattle, WA (USA); 1-5 May 1988)			
	15:1049	*See* AGARD-CP–437-VOL-2			
CONF-880551–		(11. DOE computer security group conference; Kansas City, MO (USA); 3-5 May 1988)			
Summs.	15:1982	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001114	MF-900
CONF-880601–		(American Nuclear Society annual meeting; San Diego, CA (USA); 12-16 Jun 1988)			
	15:133				
	15:189				
	15:190				
	15:191				
	15:192				
	15:193				
	15:194				
	15:195				
	15:474				
CONF-880606–		(10. symposium on thermophysical properties; Gaithersburg, MD (USA); 20-23 Jun 1988)			
	15:949				
	15:950				
	15:1061				
CONF-8806154–		(2. international conference on vector and parallel computing: issues in applied research and development; Tromso (Norway); 6-10 Jun 1988)			
	15:1055	*See* N–89-24578			
CONF-8806236–		(1. European workshop on hadronic physics in the 1990's with multi-GeV electrons; Seillac (France); 27 Jun - 1 jul 1988)			
	15:1205				
	15:1742				
CONF-8806433–		(Workshop on two-phase fluid behavior in a space environment; Ocean City, MD (USA); 13 Jun 1988)			
	15:1056	*See* N–89-26184			
CONF-8806438–		(Tokyo Institute of Technology seminar; Tokyo (Japan); 6 Jun 1988)			
	15:220	*See* CEA-CONF–9775			
CONF-8806440–		(International workshop on baryon-baryon interaction and dibaryonic systems; Bad Honnef (Germany, F.R.); 13-16 Jun 1988)			
	15:1725	*See* Juel-Spez–501			
CONF-880665–		(33. international power source symposium; Cherry Hill, NJ (USA); 13-16 Jun 1988)			
	15:564				
CONF-8807168–		(International conference on auroral physics; Cambridge (UK); 11-15 Jul 1988)			
	15:1688	*See* N–89-26727			
CONF-880780–		(27. plenary meeting of COSPAR; Espoo (Finland); 18-29 Jul 1988)			
	15:1609				
CONF-8808273–		(ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988)			
Suppl.	15:676	ACEEE, 1001 Connecticut Ave., Washington, DC 20036			ND-350
Vol.1	15:677	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.10	15:683	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.11	15:635	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
Vol.2	15:678	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.3	15:633	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.4	15:679	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.5	15:634	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.6	15:680	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.8	15:681	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
Vol.9	15:682	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
CONF-880839–		(10. annual DOE low-level waste management conference; Denver, CO (USA); 30 Aug - 1 sep 1988)			
16	15:149	*See* EGG-M–88435			
CONF-880913–		(ANS topical meeting on emergency response: planning, technologies and implementation; Charleston, SC (USA); 26-28 Sep 1988)			
9	15:482	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001609	MF-610
CONF-8809239–		(Symposium on chemical modeling in aqueous systems II; Los Angeles, CA (USA); 25-30 Sep 1988)			
2	15:1544	*See* UCRL–98727			
CONF-8809322–		(TMS fall meeting; Chicago, IL (USA); 25-30 Sep 1988)			
	15:783	*See* N–89-19371			
CONF-880938–		(International symposium on mesons and light nuclei; Rez (Czechoslovakia); 5-10 Sep 1988)			
6	15:1735	*See* JINR-E–4-88-917			
CONF-8809410–		(Conference on instrumentation in nuclear and particle physics; Maubuisson (France); 25-29 Sep 1988)			
	15:1168	*See* LAPP-EXP–88-18			
CONF-8809411–		(Joliot-Curie School on particule physics and nuclear physics instrumentation; Maubuisson (France); 26-30 Sep 1988)			
	15:1164	*See* ISN–88-103			
CONF-880955–		(International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources; Grenoble (France); 12-16 Sep 1988)			
	15:1785	*See* CENBG–88-23			
CONF-881011–		(Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC (USA); 30 Oct - 4 nov 1988)			
	15:116				
	15:124				
	15:129				
	15:130				
	15:131				
	15:132				
	15:183				
	15:184				
	15:185				
	15:186				
	15:187				
	15:188				
	15:204				
	15:205				
	15:206				
	15:207				
	15:208				
	15:209				
	15:210				
	15:211				
	15:212				
	15:224				
	15:306				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:341				
	15:342				
	15:343				
	15:344				
	15:345				
	15:346				
	15:347				
	15:348				
	15:349				
	15:350				
	15:351				
	15:352				
	15:353				
	15:358				
	15:359				
	15:360				
	15:361				
	15:362				
	15:363				
	15:364				
	15:365				
	15:366				
	15:367				
	15:368				
	15:369				
	15:370				
	15:371				
	15:372				
	15:373				
	15:374				
	15:376				
	15:377				
	15:378				
	15:379				
	15:380				
	15:381				
	15:389				
	15:394				
	15:395				
	15:396				
	15:402				
	15:404				
	15:405				
	15:406				
	15:407				
	15:408				
	15:409				
	15:410				
	15:411				
	15:412				
	15:413				
	15:414				
	15:415				
	15:416				
	15:417				
	15:418				
	15:419				
	15:420				
	15:421				
	15:430				
	15:431				
	15:432				
	15:433				
	15:434				
	15:435				
	15:436				
	15:437				
	15:438				
	15:439				
	15:440				
	15:441				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:442				
	15:443				
	15:444				
	15:445				
	15:446				
	15:447				
	15:448				
	15:449				
	15:450				
	15:451				
	15:453				
	15:454				
	15:455				
	15:456				
	15:462				
	15:463				
	15:464				
	15:467				
	15:468				
	15:469				
	15:479				
	15:511				
	15:512				
	15:513				
	15:514				
	15:515				
	15:516				
	15:517				
	15:518				
	15:519				
	15:520				
	15:521				
	15:522				
	15:523				
	15:524				
	15:525				
	15:526				
	15:527				
	15:528				
	15:529				
	15:530				
	15:531				
	15:532				
	15:533				
	15:534				
	15:535				
	15:536				
	15:537				
	15:538				
	15:540				
	15:541				
	15:542				
	15:543				
	15:544				
	15:545				
	15:546				
	15:632				
	15:728				
	15:1003				
	15:1004				
	15:1005				
	15:1006				
	15:1007				
	15:1008				
	15:1202				
	15:1220				
	15:1406				
	15:1438				
	15:1439				
	15:1836				
	15:1837				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:1841				
	15:1842				
	15:1843				
	15:1844				
	15:1845				
	15:1846				
	15:1847				
	15:1910				
CONF-8810112–		(34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV (USA); 17-21 Oct 1988)			
9	15:111	*See* EGG-M–88287			
CONF-8810116–		(Seminar on mobility of colloidal particles in the subsurface: chemistry and hydrology of colloid-aquifer interactions; Manteo, NC (USA); 4-6 Oct 1988)			
Summ.	15:1468	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000724	MF-403
CONF-8810192–		(72. specialists meeting on application of advanced materials for turbomachinery and rocket propulsion; Bath (UK); 3-5 Oct 1988)			
	15:756	*See* AGARD-CP–449			
CONF-8810299–		(Interacting electrons in reduced dimensions; Torino (Italy); 3-7 Oct 1988)			
5	15:1852	*See* LA-UR–89-3008			
CONF-881031–		(8. topical meeting on technology of fusion energy; Salt Lake City, UT (USA); 9-13 Oct 1988)			
75	15:1931	*See* EGG-M–88267			
CONF-8810341–		(Global catastrophes conference; Snowbird, UT (USA); 20-23 Oct 1988)			
	15:1473	*See* N–89-21287			
CONF-8810431–		(Accelerator automation application toolkit workshop; Los Alamos, NM (USA); 31 Oct - 4 nov 1988)			
	15:1095	*See* LA-UR–89-3111			
CONF-8810432–		(SPIE symposium of high power microwave devices; Los Angeles, CA (USA); Oct 1988)			
1	15:1114	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001066	MF-414
CONF-8810439–		(International workshop on calorimeter simulation; Juelich (Germany, F.R.); 11-13 Oct 1988)			
	15:1166	*See* Juel-Conf–67			
CONF-881045–		(Annual meeting of the Geothermal Resources Council; San Diego, CA (USA); 9-12 Oct 1988)			
9	15:296	*See* EGG-M–88242			
CONF-881097–		(1. conference on consequences of the greenhouse effect for biological diversity; Washington, DC (USA); 4-8 Oct 1988)			
1	15:1253	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016803	MF-402
CONF-8811171–		(17. INS international symposium on nuclear physics at intermediate energies; Tokyo (Japan); 15-17 Nov 1988)			
6	15:1736	*See* JINR-E–4-89-11			
CONF-8811259–		(Conference on the use of advanced computer architectures in chemical engineering; Washington, DC (USA); 27 Nov - 2 dec 1988)			
1	15:1985	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017908	MF-401
CONF-8811276–		(1. Latin-American conference on space geophysics; Aguas de Lindoia (Brazil); 21-25 Nov 1988)			
	15:1554	*See* INIS-BR–1624			
CONF-8811277–		(35. Brazilian Congress of Geology; Belem (Brazil); 6-13 Nov 1988)			
	15:1469	*See* INIS-BR–1628			
	15:1470	*See* INIS-BR–1629			
	15:1471	*See* INIS-BR–1630			
CONF-881128–		(Eastern oil shale symposium; Lexington, KY (USA); 30 Nov - 2 dec 1988)			
2	15:104	*See* EGG-M–88320			
CONF-881143–		(American Institute of Chemical Engineers annual meeting; Washington, DC (USA); 27 Nov - 2 dec 1988)			
	15:35	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:54	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:55	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:56	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:57	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:58	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:181	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:312	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:1999	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:2000	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
CONF-881155–		(Fall meeting of the Materials Research Society; Boston, MA (USA); 28 Nov - 3 dec 1988)			
44	15:1848	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89006038	MF-404
CONF-881170–		(International symposium on geothermal energy; Kumamoto (Japan); 10-14 Nov 1988)			
	15:292	*See* GRSJ–8901			
CONF-8812114–		(CANU workshop on proposals for experiments in the COSY cooled synchrotron in Juelich; Bad Honnef (Germany, F.R.); 20-21 Dec 1988)			
	15:1147	*See* Juel-Spez–489			
CONF-881297–		(1988 JSES and JWEA joint conference; Kumamoto (Japan); 1-2 Dec 1988)			
	15:238	*See* JSES–8801			
CONF-890123–		(27. AIAA aerospace sciences meeting; Reno, NV (USA); 9-12 Jan 1989)			
	15:974	*See* N–89-19446			
CONF-890207–		(Waste management '89; Tucson, AZ (USA); 26 Feb - 2 mar 1989)			
36	15:148	*See* EGG-M–88389			
CONF-8902117–		(Symposium on physical metallurgy of controlled expansion invar-type alloys; Las Vegas, NV (USA); 28 Feb 1989)			
3	15:798	*See* PNL-SA–16212			
CONF-8902146–		(CANU workshop on polarization physics at COSY; Bad Honnef (Germany, F.R.); 14-15 Feb 1989)			
	15:1125	*See* Juel-Spez–496			
CONF-8903132–		(24. Rencontres de Moriond: electroweak interactions and unified theories; Les Arcs (France); 5-12 Mar 1989)			
10	15:1719	*See* ANL-HEP-CP–89-53			
CONF-8903143–		(24. Recontres de Moriond: new results in hadronic interactions; Les Arcs (France); 12-18 Mar 1989)			
6	15:1720	*See* ANL-HEP-CP–89-60			
CONF-8903157–		(1. international conference on indium phosphide; Norman, OK (USA); 20-22 Mar 1989)			
	15:246	*See* N–89-23025			
CONF-8303170–		(Power system planning and engineering: research needs and priorities; Houston, TX (USA); 14-16 Mar 1989)			
Summ.	15:649	*See* EPRI-EL–6503			
CONF-8903172–		(10. two-yearly meeting on nuclear physics; Aussois (France); 6-10 Mar 1989)			
	15:1724	*See* ISN–89-12			
CONF-890335–		(13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989)			
260	15:1141	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002243	MF-414
261	15:1142	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002227	MF-414
262	15:1109	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002228	MF-414
263	15:1110	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002242	MF-414
264	15:1106	*See* BNL–43346			
265	15:1143	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002248	MF-414
266	15:1144	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002252	MF-414
268	15:1145	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002240	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
269	15:1869	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002241	MF-414
270	15:1111	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002253	MF-414
CONF-890388–		(4. European Physical Society (EPS) seminar on international research facilities; Zagreb (Yugoslavia); 17-19 Mar 1989)			
	15:1775	*See* GSI–89-63(prepr.)			
CONF-890422–		(International conference on municipal waste combustion; Hollywood, FL (USA); 11-14 Apr 1989)			
3	15:731	*See* BNL–42593			
CONF-8904232–		(Pacific basin conference on hazardous waste; Singapore (China); 2-7 Apr 1989)			
2	15:1317	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002271	MF-602
CONF-8904234–		(10. and final workshop on grand unification; Chapel Hill, NC (USA); 20-22 Apr 1989)			
2	15:1153	*See* ANL-HEP-CP–89-52			
CONF-8904274–		(NRC regulatory information conference; Washington, DC (USA); 18-20 Apr 1989)			
Vol.2	15:493	*See* NUREG/CP–0102-Vol.2			
CONF-8904276–		(DOE carbon dioxide research program workshop; Germantown, MD (USA); 24-25 Apr 1989)			
1	15:1280	*See* UCRL–101736			
CONF-8904280–		(International conference on electromagnetic transitions in atomic nuclei; Tashkent (USSR); 18-21 Apr 1989)			
1	15:1804	*See* JINR-E–6-89-413			
CONF-890468–		(16. international conference on metallurgical coatings and equipment exhibit; San Diego, CA (USA); 17-21 Apr 1989)			
13	15:819	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002269	MF-404
14	15:820	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002265	MF-373
CONF-890480–		(Conference on oxygen disorder effects in high T_c superconductors; Trieste (Italy); 18-21 Apr 1989)			
3	15:821	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002264	MF-404
CONF-890488–		(4. international symposium on ceramics in nuclear waste management; Indianapolis, IN (USA); 23-27 Apr 1989)			
11-Vugraphs	15:967	*See* WSRC-RP–89-77			
12	15:138	NTIS, PC A03/MF A01; OSTI; INIS		DE90002257	MF-510
13	15:139	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002254	MF-721
CONF-8905126–		(Workshop on cold fusion phenomena; Santa Fe, NM (USA); 23-25 May 1989)			
6	15:1883	*See* BNL–42852			
CONF-8905143–		(NATO advanced study institute international advanced course on the nuclear equation of state; Peniscola (Spain); 12 May - 3 jun 1989)			
17	15:1807	*See* LBL–27617			
CONF-8905148–		(2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from nuclear installations; Leuembourg (Netherlands); 16-19 May 1989)			
2	15:1286	*See* WSRC-RP–89-388			
CONF-8905190–		(5. international conference on electrostatic accelerators and associated boosters; Heidelberg (Germany, F.R.); 24-30 May 1989)			
1	15:1090	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002197	MF-413
CONF-8905208–		(3. international conference on elastic and diffractive scattering; Evanston, IL (USA); 2-6 May 1989)			
2	15:1731	*See* ANL-HEP-CP–89-104			
CONF-8905224–		(ITER impurity control workshop; Princeton, NJ (USA); May 1989)			
1	15:1921	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001566	MF-427
CONF-8905226–		(9. international conferencew on event-related potentials of the brain; Noordwijk (Netherlands); 28 May - 3 jun 1989)			
1	15:1402	*See* LA-UR–89-3265			
CONF-8905227–		(International conference on radiosurgery a neurosurgical approach to intracranial lesions; Charlottesville, VA (USA); 1-5 May 1989)			
1	15:1435	*See* LBL–27638			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8905228–		(9. biennial SSI/Princeton conference on space manufacturing; Princeton, NJ (USA); 10 May 1989)			
	15:253	*See* N–89-26799			
CONF-8905231–		(Conference on neutron scattering days at Studsvik; Studsvik (Sweden); 22-24 May 1989)			
1	15:1829	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001408	MF-411; MF-404
CONF-8905232–		(4. workshop on perspectives in nuclear physics at intermediate energies; Trieste (Italy); 8-12 May 1989)			
1	15:1097	*See* TRI-PP–89-63			
CONF-8905235–		(Symposium on biomedical sciences: function and structure of nucleic acids and proteins; Taipei (Taiwan); 13 May 1989)			
1	15:1368	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001610	MF-408
CONF-890526–		(44. annual Purdue industrial waste conference; West Lafayette, IN (USA); 9-11 May 1989)			
2	15:1254	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002196	MF-400; MF-402
CONF-890545–		(6. conference on real-time computer applications in nuclear, particle and plasma physics; Williamsburg, VA (USA); 15-19 May 1989)			
	15:470				
	15:1014				
	15:1103				
	15:1132				
	15:1133				
	15:1134				
	15:1135				
	15:1136				
	15:1137				
	15:1138				
	15:1139				
	15:1140				
	15:1209				
	15:1913				
	15:1976				
	15:2009				
	15:2010				
CONF-890560–		(12. international conference on cyclotrons and their applications; Berlin (Germany, F.R.); 8-12 May 1989)			
3	15:1094	*See* JINR-E–9-89-324			
CONF-890563–		(CORS/TIMS/ORSA joint national meeting; Vancouver (Canada); 8-10 May 1989)			
3	15:1255	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002201	MF-101
CONF-890583–		(Symposium on the occasion of the 40th anniversary of the nuclear shell model; Argonne, IL (USA); 25-27 May 1989)			
4	15:1730	*See* ANL-HEP-CP–89-87			
CONF-890605–		(11. information processing in medical imaging international conference; Berkeley, CA (USA); 19-23 Jun 1989)			
2	15:1214	*See* LBL–26499			
CONF-8906112–		(7. symposium on energy engineering sciences; Argonne, IL (USA); 19-21 Jun 1989)			
	15:1051	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000872	MF-400
3	15:766	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002214	MF-404
CONF-8906134–		(24. AIAA thermophysics conference; Buffalo, NY (USA); 11-15 Jun 1989)			
	15:1053	*See* N–89-23818			
CONF-8906169–		(International Astronautics Federation conference on space power; Cleveland, OH (USA); 5-7 Jun 1989)			
	15:248	*See* N–89-26041			
	15:400	*See* N–89-25272			
CONF-8906194–		(International meeting on physics at KAON; Bad Honnef (Germany, F.R.); 7-9 Jun 1989)			
3	15:1737	*See* LA-UR–89-3426			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8906199–		(9. international conference on physics in collision; Jerusalem (Israel); 19-21 Jun 1989)			
3	15:1732	*See* ANL-HEP-CP–89-107			
CONF-8906200–		(Large area electron beam diode workshop; Monterey, CA (USA); 7 Jun 1989)			
3	15:997	*See* SAND–89-2216C			
CONF-8906228–		(2. national congress on mechanics; Athens (Greece); 29 Jun - 1 jul 1989)			
	15:1084	*See* N–89-25490			
CONF-8906230–		(LASER '89: 9th international congress on optoelectronics microwaves; Munich (Germany, F.R.); 5-9 Jun 1989)			
1	15:1169	*See* LBL–26321			
CONF-8906231–		(Research Coordination Program meeting on the performance of solidified high-level waste forms and engineering barriers under repository conditions; Winnipeg (Canada); 5-8 Jun 1989)			
1	15:168	*See* PNL-SA–17002			
CONF-8906232–		(7. AAECC international conference; Toulouse Cedex (France); 26 Jun 1989)			
1	15:1165	*See* JINR-E–10-89-362			
CONF-890692–		(82. Air and Waste Management Association annual meeting and exhibition; Anaheim, CA (USA); 25-30 Jun 1989)			
23	15:1256	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002216	MF-402
CONF-890701–		(International cryogenic materials conference; Los Angeles, CA (USA); 24-28 Jul 1989)			
11	15:998	*See* UCRL–100272			
12	15:1122	*See* FNAL-TM–1617			
14	15:780	*See* LBL–27378			
15	15:779	*See* LBL–27377			
17	15:1123	*See* FNAL-TM–1618			
18	15:1124	*See* FNAL-TM–1619			
CONF-890703–		(International conference on ion sources; Berkeley, CA (USA); 10-14 Jul 1989)			
20	15:1112	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002189	MF-414
CONF-8907114–		(International conference on martensitic phase transformations (ICOMAT-89); Sydney (Australia); 3-7 Jul 1989)			
3	15:767	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002182	MF-404
CONF-8907130–		(9. vacuum ultraviolet radiation conference; Honolulu, HI (USA); 17-21 Jul 1989)			
5	15:1698	*See* UCRL–100904			
CONF-8907140–		(18. international conference on differential geometric methods in theoretical physics: physics and geometry; Tahoe City, CA (USA); 2-8 Jul 1989)			
2	15:1763	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001451	MF-414
CONF-8907152–		(Short course on high-pressure equations of state: theory and applications; Varenna (Italy); 25 Jul - 4 aug 1989)			
1	15:947	*See* UCRL–101908			
CONF-8907153–		(DOE/NV productivity improvement training seminar; Las Vegas, NV (USA); 13-14 Jul 1989)			
1	15:999	*See* UCRL–101399			
CONF-8907155–		(19. intersociety conference on environmental systems; San Diego, CA (USA); 24-26 Jul 1989)			
	15:250	*See* N–89-26177			
CONF-8907157–		(4. international conference on STM; Oarai (Japan); 10-14 Jul 1989)			
1	15:781	*See* LBL–27563			
CONF-890718–		(International conference on materials and mechanisms of superconductivity - high-temperature superconductors; Stanford, CA (USA); 23-28 Jul 1989)			
32	15:1868	*See* BNL–43198			
CONF-890771–		(American Crystallographic Association annual meeting; Seattle, WA (USA); 23-29 Jul 1989)			
5	15:762	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002183	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890798–		(AIRAPT and EHPRG international high pressure science and technology conference; Paderborn (Germany, F.R.); 17-21 Jul 1989)			
13	15:1828	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002185	MF-411
CONF-890802–		(7. synchrotron radiation instrumentation (SRI) national conference; Berkeley, CA (USA); 6-10 Aug 1989)			
13	15:1215	*See* LBL–27668			
14	15:1107	*See* BNL–43374			
CONF-890803–		(International conference on high energy accelerators; Tsukuba (Japan); 20-26 Aug 1989)			
36	15:1128	*See* LBL–27663			
CONF-8908108–		(American Statistical Association meeting; Washington, DC (USA); 9 Aug 1989)			
3	15:1466	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001644	MF-400
CONF-890811–		(9. international symposium on detonation; Portland, OR (USA); 28 Aug - 1 sep 1989)			
39	15:230	*See* UCRL–101953			
CONF-890812–		(American Physical Society topical conference on shock compression of condensed matter; Albuquerque, NM (USA); 14-17 Aug 1989)			
59	15:800	*See* UCRL–100833			
60	15:837	*See* UCRL–100792			
61	15:1604	*See* UCRL–101924			
CONF-8908131–		(2. LAMPF workshop on pion-nucleus double charge exchange; Los Alamos, NM (USA); 9-11 Aug 1989)			
2	15:1738	*See* LA-UR–89-3609			
CONF-8908133–		(24. Yamada conference on strongly coupled plasma physics; Tokyo (Japan); 29 Aug - 2 sep 1989)			
5	15:1603	*See* UCRL–101115			
CONF-8908134–		(11. international free electron laser conference; Naples, FL (USA); 28 Aug - 1 sep 1989)			
13	15:1030	*See* LA-UR–89-3486			
14	15:1036	*See* PFC/JA–89-43			
CONF-890814–		(American Institute of Chemical Engineer's summer national meeting; Philadelphia, PA (USA); 20-23 Aug 1989)			
8	15:698	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001411	MF-246
CONF-8908141–		(U.S. Department of Energy conference on technology research and development for arms control verification; Los Alamos, NM (USA); 29-31 Aug 1989)			
3-Rev.1	15:1234	*See* UCRL–101542-Rev.1			
CONF-8908145–		(4. workshop on RF superconductivity; Ibaraki-Ken (Japan); 14-18 Aug 1989)			
3	15:1115	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002173	MF-413
CONF-890815–		(24. intersociety energy conversion engineering conference; Arlington, VA (USA); 6-11 Aug 1989)			
	15:247	*See* N–89-24448			
	15:272	*See* N–89-23397			
	15:273	*See* N–89-24529			
	15:274	*See* N–89-25280			
	15:276	*See* N–89-24440			
	15:277	*See* N–89-25269			
	15:278	*See* N–89-25273			
	15:285	*See* N–89-24438			
	15:401	*See* N–89-25282			
	15:742	*See* N–89-24593			
	15:1054	*See* N–89-23823			
CONF-8908158–		(Conference on microscopic simulation of complex flows; Brussels (Belgium); 21-25 Aug 1989)			
2	15:1067	*See* UCRL–101903			
CONF-8908159–		(IRIS conference; Monterey, CA (USA); 14-17 Aug 1989)			
1	15:255	*See* SAND–89-1900C			
CONF-8908164–		(Molecular biology of photosynthetic prokaryotea symposium; Freiburg (Germany, F.R.); 2-5 Aug 1989)			
1	15:241	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001412	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8908165–		(5. international conference on PIXE and its analytical applications; Amsterdam (Netherlands); 20-26 Aug 1989)			
1	15:1212	*See* BNL–43250			
CONF-8908166–		(Annual seminar of the Canadian Mathematical Society; Montreal (Canada); 1-11 Aug 1989)			
1	15:1764	*See* DOE/ER/13065–589			
CONF-8908167–		(Hot stars workshop; Boulder, CO (USA); 6-11 Aug 1989)			
1	15:1569	*See* LA-UR–89-3310			
CONF-8908168–		(AIChE meeting on controls of accidental releases of hazardous gases; Philadelphia, PA (USA); Aug 1989)			
1	15:727	*See* UCRL–101995			
CONF-8908169–		(32. annual meeting of the Japan Radiation Research Society; Kitakyushu-shi (Japan); 29 Aug 1989)			
1	15:1436	*See* LBL–27728			
CONF-8908170–		(3. international conference on synchrotron radiation instrumentation; Tsukuba (Japan); 29 Aug - 2 sep 1989)			
1	15:1105	*See* BNL–43335			
CONF-890820–		(4. international symposium on environmental degradation of materials in nuclear power systems: water reactors; Jekyll Island, GA (USA); 6-10 Aug 1989)			
5	15:763	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001773	
CONF-890828–		(2. world congress on heating, ventilating, refrigerating and air conditioning; Sarajevo (Yugoslavia); 27 Aug - 1 sep 1989)			
2	15:280	NTIS, PC A02/MF A01 - OSTI		DE90001727	MF-350
CONF-890836–		(33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA (USA); 6-11 Aug 1989)			
17	15:1907	*See* UCRL–100498			
CONF-890845–		(4. international energy conservation program evaluation conference; Chicago, IL (USA); 21-25 Aug 1989)			
5	15:654	*See* PNL-SA–16957			
CONF-890855–		(10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989)			
59	15:390	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002181	MF-500
CONF-890875–		(3. international symposium on foundations of quantum mechanics; Tokyo (Japan); 27-31 Aug 1989)			
2	15:1779	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002180	MF-413
3	15:1880	*See* LA-UR–89-3576			
CONF-890902–		(198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep 1989)			
17	15:17	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001766	MF-401
18	15:18	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001983	MF-401
19	15:1799	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001984	MF-413
CONF-8909128–		(Oceans '89 conference; Seattle, WA (USA); 18-21 Sep 1989)			
4	15:279	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001432	MF-262
CONF-8909141–		(12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989)			
2	15:475	NTIS, PC A03/MF A01; OSTI; INIS		DE90001440	MF-525
CONF-890916–		(6. annual international Pittsburgh coal conference; Pittsburgh, PA (USA); 25-29 Sep 1989)			
3	15:7	*See* EGG-M–89235			
4	15:8	*See* EGG-M–89237			
5	15:21	*See* EGG-M–89181			
CONF-8909163–		(5. symposium on containment of underground nuclear detonations; Santa Barbara, CA (USA); 19-21 Sep 1989)			
Absts.	15:1228	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017760	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8909170–		(12. annual Madison waste conference; Madison, WI (USA); 20-21 Sep 1989)			
2	15:1327	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001767	
CONF-8909180–		(ANL conference on the prevention of significant safety-related events in the operation of US Department of Energy nuclear facilities; Richland, WA (USA); 11-14 Sep 1989)			
2	15:174	*See* WHC-SA–0718			
CONF-8909182–		(NATO advanced study institute on chemistry and physics of molecular processes in energetic materials; Sicily (Italy); 2-15 Sep 1989)			
3	15:1221	*See* LA-UR–89-3000			
CONF-8909188–		(Knoxville - East Tennessee Chapter of the ARMA seminar; 34. annual ARMA international conference: building bridges of professionalism; Knoxville - East Tennessee Chapter of ARMA meeting; Alcoa, TN (USA); New Orleans, LA (USA); Knoxville, TN (USA); 13-14 Sep 1989; 2-5 oct 1989; 14)			
1	15:2011	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016039	MF-400
CONF-890920–		(14. international conference on organic geochemistry; Paris (France); 18-22 Sep 1989)			
2	15:107	*See* UCRL–101859			
CONF-8909204–		(Conference on hydrogen effects on material behavior; Jackson Hole, WY (USA); 12-16 Sep 1989)			
3	15:799	*See* SAND–89-2413C			
4	15:1884	*See* EGG-M–89099			
CONF-8909216–		(DARPA/SDIO service annual charged particle beam review; Monterey, CA (USA); 18-21 Sep 1989)			
2	15:1697	*See* SAND–89-2191C			
CONF-8909218–		(3. international workshop on low temperature detectors for neutrinos and dark matter; L'Aquila (Italy); 20-23 Sep 1989)			
1	15:1161	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001985	MF-414
CONF-8909219–		(Society of Automotive Engineers (SAE) international fuels and lubricants meeting; Baltimore, MD (USA); 25-28 Sep 1989)			
1	15:743	*See* SAND–89-2222C			
2	15:745	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001765	MF-920
CONF-8909225–		(Actinides '89; Tashkent (USSR); 24-29 Sep 1989)			
1	15:768	*See* DOE/ER/13834–8			
2	15:777	*See* LA-UR–89-3135			
CONF-8909229–		(Aeroballistic Range Association meeting; Paris (France); 24-28 Sep 1989)			
1	15:996	*See* SAND–89-2034C			
CONF-8909231–		(Computer software and applications conference; Orlando, FL (USA); 20-22 Sep 1989)			
1	15:1986	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001429	MF-405
CONF-8909232–		(8. Japan - United States Governmental conference on solid waste management; Honolulu, HI (USA); 6-7 Sep 1989)			
1	15:1297	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001431	MF-402
CONF-8909233–		(Workshop on towards establishing b factory; Syracuse, NY (USA); 6-9 Sep 1989)			
1	15:1721	*See* ANL-HEP-CP–89-102			
CONF-8909234–		(Advisory group meeting on nuclear data for radiation damage assessment and related safety aspects; Vienna (Austria); 19-22 Sep 1989)			
1	15:1922	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001443	MF-423
CONF-8909235–		(Technical committee meeting on fundamental aspects of corrosion of zirconium-based alloys in water reactor environments; Portland, OR (USA); 11-15 Sep 1989)			
1	15:357	*See* PNL-SA–17065			
2	15:335	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001439	MF-523
CONF-8909236–		(JAERI/EPA workshop on residual radiation and recycle criteria; St. Michaels, MD (USA); 27-28 Sep 1989)			
1	15:500	*See* PNL-SA–17354			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8909238–		(ITER technical committee meeting; Garching (Germany, F.R.); 27 Sep 1989)			
1	15:1890	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001346	MF-420
CONF-8909240–		(ICSF12: 12th international conference on software engineering; Nice (France); Sep 1989)			
1	15:1998	*See* UCRL–101437			
CONF-8909241–		(5. Brazilian meeting on analytical chemistry; Salvador (Brazil); 4-6 Sep 1989)			
	15:922	*See* INIS-BR–1633			
	15:923	*See* INIS-BR–1634			
CONF-8909243–		(Global natural resource monitoring and assessments: preparing for the 21st century; Venice (Italy); 24-30 Sep 1989)			
1	15:1257	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001635	MF-402
CONF-8909247–		(ACS symposium on exotic nuclear spectroscopy; Miami Beach, FL (USA); 11-15 Sep 1989)			
2	15:1789	*See* BNL–43057			
CONF-8909249–		(Lattice '89 international workshop; Capri (Italy); Sep 1989)			
1	15:1878	*See* DOE/ER/25009–831			
CONF-890928–		(Nuclear waste isolation in the unsaturated zone: FOCUS '89; Las Vegas, NV (USA); 18-21 Sep 1989)			
9	15:155	*See* LA-UR–89-3210			
10	15:1318	*See* EGG-M–89063			
CONF-890953–		(International conference on the physics of highly correlated electron systems; Santa Fe, NM (USA); 11-15 Sep 1989)			
8	15:870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001981	MF-404
10	15:1872	*See* LA-UR–89-3336			
CONF-890971–		(Conference on superconductivity and applications; Buffalo, NY (USA); 19-21 Sep 1989)			
3	15:822	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001762	MF-364
4	15:823	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001988	MF-404
5	15:1870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001968	MF-404; MF-410
CONF-890982–		(International meeting on neutron activation cross section for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989)			
4	15:1918	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001437	MF-413
CONF-891001–		(International conference on coal science; Tokyo (Japan); 23-27 Oct 1989)			
8	15:19	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001913	MF-401
CONF-891007–		(13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989)			
22	15:1888	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002152	MF-420
24	15:1889	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001737	MF-420
35	15:1938	*See* EGG-M–89216			
36	15:1939	*See* EGG-M–89239			
37	15:1934	*See* EGG-M–89206			
38	15:1937	*See* EGG-M–89214			
39	15:1936	*See* EGG-M–89213			
40	15:1932	*See* EGG-M–89202			
41	15:1933	*See* EGG-M–89204			
42	15:1935	*See* EGG-M–89208			
43	15:1908	*See* UCRL–101947			
44	15:1971	*See* UCRL–101063			
45	15:1940	*See* EGG-M–89279			
46	15:1962	*See* LA-UR–89-3482			
47	15:1952	*See* LA-UR–89-3281			
49	15:1972	*See* UCRL–102100			
50	15:1945	*See* LA-UR–89-3233			
51	15:1946	*See* LA-UR–89-3261			
52	15:1947	*See* LA-UR–89-3262			
54	15:1948	*See* LA-UR–89-3271			
55	15:1959	*See* LA-UR–89-3353			
56	15:1958	*See* LA-UR–89-3352			
57	15:1949	*See* LA-UR–89-3276			
59	15:1950	*See* LA-UR–89-3279			
60	15:1951	*See* LA-UR–89-3280			
61	15:1953	*See* LA-UR–89-3291			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
62	15:1960	*See* LA-UR–89-3382			
63	15:1961	*See* LA-UR–89-3383			
65	15:1901	*See* LA-UR–89-3327			
66	15:1957	*See* LA-UR–89-3322			
67	15:1956	*See* LA-UR–89-3299			
68	15:1955	*See* LA-UR–89-3298			
70	15:1954	*See* LA-UR–89-3293			
73	15:1919	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002471	MF-420
CONF-891013–		(6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989)			
4	15:1345	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001941	MF-401; MF-403
5	15:917	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001958	MF-400
CONF-8910162–		(11. annual North American conference of the International Association for Energy Economists; Los Angeles, CA (USA); 16-18 Oct 1989)			
4	15:588	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001349	MF-400
CONF-8910192–		(2. DOE natural phenomena hazards mitigation conference; Knoxville, TN (USA); 3-5 Oct 1989)			
11	15:506	*See* WSRC-RP–89-25			
12	15:1319	*See* WHC-SA–0606			
13	15:115	*See* WHC-SA–0603			
14	15:505	*See* WHC-SA–0753			
CONF-891020–		(Annual conference and exhibition of the Water Pollution Control Federation; San Francisco, CA (USA); 15-19 Oct 1989)			
1	15:140	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001641	MF-402
CONF-8910205–		(Knoxville - East Tennessee Chapter of the ARMA seminar; 34. annual ARMA international conference: building bridges of professionalism; Knoxville - East Tennessee Chapter of ARMA meeting; Alcoa, TN (USA); New Orleans, LA (USA); Knoxville, TN (USA); 13-14 Sep 1989; 2-5 oct 1989; 14)			
1	15:2011	*See* CONF-8909188–1			
CONF-8910222–		(17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989)			
Summs.	15:494	*See* NUREG/CP–0104			
CONF-8910224–		(American Defense Preparedness Association annual meeting; New Orleans, LA (USA); 3-4 Oct 1989)			
1	15:1223	*See* SAND–89-2259C			
CONF-8910225–		(IAEA technical committee meeting on ICRH/edge physics; Munich (Germany, F.R.); 2-5 Oct 1989)			
2	15:1923	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001354	MF-420
3	15:1924	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001757	MF-420
4	15:1925	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001959	MF-421
5	15:1926	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001334	MF-420
CONF-8910227–		(50. anniversary of nuclear fission; Leningrad (USSR); 16-20 Oct 1989)			
1	15:1791	*See* UCRL–101174			
CONF-8910229–		(40. congress of the International Astronautical Federation; Malaga (Spain); 7-13 Oct 1989)			
	15:990	*See* N–89-26044			
CONF-8910235–		(Joint U.S. National Academy of Sciences of the USSR seminar on global energy development and associated ecological (environmental) impacts in Moscow; Moscow (USSR); 17-20 Oct 1989)			
1	15:616	NTIS, PC A03/MF A01 - OSTI		DE90001359	MF-402
CONF-8910237–		(International school seminar on heavy ion physics; Dubna (USSR); 3-12 Oct 1989)			
2	15:1780	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001608	MF-413
CONF-8910239–		(13. annual TRADE conference; Baltimore, MD (USA); 22-25 Oct 1989)			
1	15:478	*See* WHC-SA–0730			
CONF-8910241–		(35. conference on bioassay, analytical and environmental chemistry; Charleston, SC (USA); 30 Oct - 2 nov 1989)			
1	15:1229	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001482	MF-702

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8910243–		(European space power conference; Madrid (Spain); 2-6 Oct 1989)			
	15:251	*See* N–89-26201			
	15:252	*See* N–89-26292			
	15:275	*See* N–89-25506			
CONF-8910246–		(Annual meeting of the Society for Risk Analysis; Washington, DC (USA); 31 Oct - 2 nov 1989)			
1	15:1987	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001416	MF-405
CONF-8910253–		(2. international conference on cyclic nucleotide phosphodiesterase; Tokushima (Japan); 4-6 Oct 1989)			
1	15:1373	*See* LA-UR–89-3232			
CONF-8910255–		(International workshop on severe accidents and their consequences; Sochi City (USSR); 30 Oct - 1 nov 1989)			
1	15:503	*See* SAND–89-2547C			
CONF-8910267–		(American Chemical Society Rubber Division national meeting; Detroit, MI (USA); 18 Oct 1989)			
1	15:896	*See* SAND–89-2441C			
CONF-8910268–		(28. Army operations research symposium; Ft. Lee, VA (USA); 11-12 Oct 1989)			
1	15:1232	*See* UCRL–101706			
CONF-891027–		(International symposium on research reactor safety, operations and modifications; Chalk River (Canada); 23-27 Oct 1989)			
3	15:483	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001361	MF-400
4	15:484	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001345	MF-400
CONF-891036–		(Joint American Society of Mechanical Engineers/Society of Tribologists and Lubrication Engineers tribology conference; Ft. Lauderdale, FL (USA); 16-19 Oct 1989)			
	15:943	*See* N–89-19402			
CONF-891044–		(1. international conference on radioactive nuclear beams; Berkeley, CA (USA); 16-18 Oct 1989)			
1	15:1762	*See* ANL-HEP-CP–89-55			
CONF-891046–		(Advanced research and technology development; Morgantown, WV (USA); 3-5 Oct 1989)			
2	15:24	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001929	MF-401
3	15:300	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001939	MF-105
CONF-891053–		(28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?; Richland, WA (USA); 16-19 Oct 1989)			
4	15:167	*See* PNL-SA–16955			
6	15:1341	*See* PNL-SA–16897			
CONF-891055–		(5. international symposium on the production and neutralization of negative ions and beams; Upton, NY (USA); 30 Oct - 3 nov 1989)			
1	15:1113	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002476	MF-413
CONF-891057–		(3. international symposium on borehole geophysics; Las Vegas, NV (USA); 2-5 Oct 1989)			
2	15:1296	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001337	
CONF-891067–		(Superconductivity: the manufacturing challenges conference and tabletop exhibits; Oak Brook, IL (USA); 16-18 Oct 1989)			
1	15:877	*See* LA-UR–89-3301			
CONF-891077–		(International conference on decommissioning of nuclear installations; Brussels (Belgium); 24-27 Oct 1989)			
1	15:487	*See* DOE/SSDP–0082			
CONF-891087–		(IEEE nuclear science symposium and exhibits; San Francisco, CA (USA); 25-27 Oct 1989)			
6	15:1160	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001960	MF-406
CONF-891091–		(8. international congress on applications of lasers and electro-optics (ICALEO 8); Orlando, FL (USA); 15-20 Oct 1989)			
2	15:871	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001739	MF-406; MF-404
CONF-891093–		(36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989)			
8	15:1873	*See* LA-UR–89-3499			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-891094–		(International conference on accelerator and large experimental physics control systems; Vancouver (Canada); 30 Oct - 3 nov 1989)			
1	15:1127	*See* LA-UR–89-3596			
2	15:1148	*See* LA-UR–89-3560			
3	15:1126	*See* LA-UR–89-3534			
CONF-891103–		(Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989)			
2	15:391	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89012390	MF-530
3	15:169	*See* RFP–4352			
4	15:1776	*See* LA-UR–89-2210			
5	15:1806	*See* LA-UR–89-2209			
6	15:1798	*See* LA-UR–89-2207			
7	15:153	*See* LA-UR–89-2124			
8	15:214	*See* LA-UR–89-2046			
9	15:152	*See* LA-UR–89-2032			
10	15:216	*See* SAND–89-1706C			
11	15:1422	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014075	MF-407
12	15:126	*See* GA-A–19701			
13	15:340	*See* SAND–89-1739C			
15	15:473	*See* SAND–89-1909C			
16	15:1881	*See* UCRL–101302			
17	15:217	*See* UCRL–101305			
18	15:422	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015903	MF-605
19	15:1797	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015871	MF-700
20	15:125	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015893	MF-700
21	15:141	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015873	MF-721
22	15:457	*See* LA-UR–89-2418			
23	15:489	*See* EGG-M–89187			
24	15:1920	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016231	MF-423
25	15:118	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016267	MF-526
26	15:119	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016290	MF-526
27	15:1437	*See* UCRL–101507			
28	15:480	*See* WSRC-RP–89-385			
29	15:1774	*See* BNL-NCS–43194			
31	15:173	*See* WHC-SA–0661			
33	15:1000	*See* WSRC-RP–89-518			
35	15:392	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001923	MF-532
36	15:113	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001925	MF-532
39	15:987	*See* EGG-M–89303			
40	15:156	*See* LBL–27428			
CONF-891108–		(International symposium on recovery operations in the event of a nuclear power plant accident; Vienna (Austria); 6-10 Nov 1989)			
1	15:504	*See* UCRL–101842			
CONF-8911100–		(Taniguchi conference on polymer research by neutron scattering; Kyoto (Japan); 7-9 Nov 1989)			
1	15:874	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000574	MF-411
CONF-8911101–		(ASM conference on methods for reducing scrap in producing tubes, bars and shapes; Clearwater, FL (USA); 6-7 Nov 1989)			
1	15:114	*See* WHC-SA–0548			
CONF-8911103–		(Japan Atomic Energy Research Institute symposium; Takasaki (Japan); 6-10 Nov 1989)			
1	15:1211	*See* SAND–89-2539C			
CONF-8911104–		(Symposium on corrosion testing and evaluation; Orlando, FL (USA); 6-7 Nov 1989)			
1	15:176	*See* WSRC-RP–89-511			
CONF-891113–		(American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989)			
4	15:1983	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001964	MF-406
CONF-891116–		(First international SAMPE symposium and exhibition on new materials and processes for the future; Chiba (Japan); 28 Nov - 1 dec 1989)			
1	15:824	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012331	MF-332
CONF-891117–		(34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989)			
1	15:876	*See* LA-UR–89-3002			
2	15:875	*See* LA-UR–89-3001			
3	15:760	*See* BNL–43296			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4	15:1129	*See* UCRL–101299			
5	15:764	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001930	MF-404
9	15:1849	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002475	MF-410
CONF-891118–		(International meeting on nuclear criticality safety margins; San Francisco, CA (USA); 26 Nov - 1 dec 1989)			
1	15:151	*See* LA-UR–89-2017			
2	15:897	*See* WSRC-RP–89-386			
3	15:986	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015894	MF-820
4	15:423	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016164	MF-405; MF-406
5	15:490	*See* EGG-M–89256			
6	15:452	*See* WHC-SA–0663			
8	15:120	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017764	MF-526
9	15:507	*See* WSRC-RP–89-376			
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989)			
1	15:765	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014779	MF-404
2	15:958	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001908	MF-814
3	15:872	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002275	MF-814
CONF-891120–		(Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere; Monterey, CA (USA); 6-10 Nov 1989)			
2	15:154	*See* LA-UR–89-3116			
3	15:873	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001758	MF-411
4	15:171	*See* UCRL–102033			
CONF-891130–		(3. international conference on processing and utilization of high-sulphur coals; Ames, IA (USA); 14-18 Nov 1989)			
1	15:29	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001907	MF-104
CONF-891140–		(Session on thermal-hydraulic aspects of passive safety; San Francisco, CA (USA); 27-30 Nov 1989)			
1	15:485	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013579	MF-522
2	15:393	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89013279	MF-520
CONF-891149–		(Supercomputing '89 conference; Reno, NV (USA); 13-17 Nov 1989)			
5	15:1988	*See* LA-UR–89-2607			
8	15:1984	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001921	MF-405
9	15:1989	*See* LBL–27821			
CONF-891150–		(IEEE conference on neutral information processing systems; Denver, CO (USA); 27-30 Nov 1989)			
1	15:1995	*See* SAND–89-1442C			
CONF-891152–		(60. shock and vibration symposium; Virginia Beach, VA (USA); 14-16 Nov 1989)			
2	15:1233	*See* SAND–89-1512C			
CONF-891159–		(GOMAC '89: government microcircuit applications conference; Orlando, FL (USA); 7-9 Nov 1989)			
1	15:1076	*See* SAND–89-0711C			
3	15:1997	*See* UCRL–100735			
CONF-891161–		(CP violation at KAON Factory conference; Vancouver (Canada); 30 Nov - 3 dec 1989)			
1	15:1733	*See* BNL–42892			
CONF-891182–		(International conference on plasma physics; New Delhi (India); 22-28 Nov 1989)			
1	15:1943	*See* LA-UR–89-2913			
2	15:1906	*See* PFC/JA–89-37			
CONF-891183–		(Knoxville - East Tennessee Chapter of the ARMA seminar; 34. annual ARMA international conference: building bridges of professionalism; Knoxville - East Tennessee Chapter of ARMA meeting; Alcoa, TN (USA); New Orleans, LA (USA); Knoxville, TN (USA); 13-14 Sep 1989; 2-5 oct 1989; 14)			
1	15:2011	*See* CONF-8909188–1			
CONF-891192–		(Annual Westinghouse computer symposium; Pittsburgh, PA (USA); 6-7 Nov 1989)			
15	15:458	*See* WHC-SA–0639			
18	15:177	*See* WSRC-RP–89-659-Rev.1			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-891194–		(First international SAMPE symposium and exhibition; Tokyo (Japan); 28 Nov - 1 dec 1989)			
1	15:778	*See* LBL–27249			
CONF-891197–		(Topical meeting on non-destructive assay of radioactive waste; Cadarache (France); 20-22 Nov 1989)			
1	15:215	*See* LA-UR–89-3171			
CONF-891198–		(6. IEEE careers conference: engineering and engineering managers: challenges of the 90's; St. Petersburg, FL (USA); 1-3 Nov 1989)			
1	15:1977	*See* UCRL–101695			
CONF-891199–		(3. Silton-Bookman Systems annual user's conference; San Francisco, CA (USA); 13 Nov 1989)			
1	15:1996	*See* SAND–89-2440C			
CREARE-TM–					
1352	15:980	*See* AD-A–209875/4/XAB			
CRIE-T–					
87077	15:1213	NTIS (US Sales Only), PC A03/MF A01		DE89901267	
87081	15:313	NTIS (US Sales Only), PC A04/MF A01		DE89901258	
87084	15:314	NTIS (US Sales Only), PC A03/MF A01		DE89901262	
87086	15:315	NTIS (US Sales Only), PC A04/MF A01		DE89901265	
87089	15:316	NTIS (US Sales Only), PC A03/MF A01		DE89901261	
87092	15:317	NTIS (US Sales Only), PC A03/MF A01		DE89901268	
87093	15:318	NTIS (US Sales Only), PC A03/MF A01		DE89901257	
87094	15:319	NTIS (US Sales Only), PC A03/MF A01		DE89901263	
87095	15:320	NTIS (US Sales Only), PC A03/MF A01		DE89901260	
87097	15:1235	NTIS (US Sales Only), PC A03/MF A01		DE89901256	
87099	15:321	NTIS (US Sales Only), PC A03/MF A01		DE89901269	
87100	15:301	NTIS (US Sales Only), PC A04/MF A01		DE89901264	
87110	15:228	NTIS (US Sales Only), PC A03/MF A01		DE89901303	
87116	15:322	NTIS (US Sales Only), PC A04/MF A01		DE89901270	
88004	15:323	NTIS (US Sales Only), PC A03/MF A01		DE89901259	
CRIE-U–					
05	15:236	NTIS (US Sales Only), PC A11/MF A01		DE89901271	
87098	15:1162	NTIS (US Sales Only), PC A03/MF A01		DE89901292	
88018	15:237	NTIS (US Sales Only), PC A03/MF A01		DE89901295	
88020	15:1350	NTIS (US Sales Only), PC A03/MF A01		DE89901255	
88023	15:1089	NTIS (US Sales Only), PC A03/MF A01		DE89901293	
88036	15:37	NTIS (US Sales Only), PC A03/MF A01		DE89901297	
88037	15:1413	NTIS (US Sales Only), PC A03/MF A01		DE89901294	
88041	15:308	NTIS (US Sales Only), PC A03/MF A01		DE89901296	
CRN-PN–					
89-03	15:1786	NTIS (US Sales Only), PC A08/MF A01		DE90713776	
CSSA-ASTRO–					
89-08	15:1584	*See* N–89-25945			
DFVLR-FB–					
87-10	15:1029	*See* ESA-TT–1120			
87-49	15:547	*See* ESA-TT–1107			
DIA-DST–					
2700Z-007-89	15:1023	*See* AD-A–209802/8/XAB			
DOE/BC/10845–					
15	15:50	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000770	PC-122
DOE/BC/10847–					
15	15:51	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000772	PC-122
DOE/BC/14403–					
2	15:47	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001752	MF-122; MF-132
DOE/CE/40835–					
T1	15:699	The American Paper Institute, Inc., 260 Madison Avenue, New York, NY 10016			ND-310
DOE/CH/10378–					
4	15:142	NTIS, PC A99/MF A01; OSTI; INIS; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE90002349	MF-800
DOE/DP/10560–					
6	15:1927	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001996	MF-712
DOE/EA–					
0408	15:93	NTIS, PC A05/MF A01 - OSTI		DE90001110	MF-630

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/EH–					
0103-Vol.1	15:1328	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000995	MF-603
0103-Vol.2	15:1329	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000996	MF-603
DOE/EIA–					
0035(89/07)	15:648	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002594	MF-950
0131(88)/1	15:91	NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002646	MF-950
0131(88)/2	15:92	NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002647	MF-950
0202(89)	15:636	NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002593	MF-950
0520(89/10)	15:65	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90001917	MF-950
0523(89/2Q)	15:48	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90001916	MF-950
M036	15:589	NTIS, PC A14/MF A01 - GPO - OSTI		DE90001699	MF-950
DOE/EIS–					
0134-F	15:1364	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002098	MF-902
0146	15:26	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001890	PC-101
DOE/ER–					
0392	15:1091	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002239	MF-414
DOE/ER/13065–					
589	15:1764	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001403	MF-410
DOE/ER/13427–					
2	15:972	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001719	MF-406
DOE/ER/13454–					
T4	15:936	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002547	MF-401
DOE/ER/13574–					
1	15:242	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001577	MF-408
DOE/ER/13834–					
8	15:768	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89017808	MF-404
DOE/ER/13881–					
2	15:918	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001567	MF-401
DOE/ER/25009–					
831	15:1878	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001426	MF-405
DOE/ER/40231–					
T6	15:1765	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000730	MF-414
T7	15:1766	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000731	MF-414
DOE/ER/40402–					
2	15:1794	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001177	MF-413
DOE/ER/45190–					
2	15:1692	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001754	MF-411
DOE/ER/45231–					
4	15:1851	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001708	MF-414
DOE/ER/45384–					
1	15:1146	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001980	MF-406
DOE/ER/53212–					
144	15:1891	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002114	MF-427
DOE/ER/53242–					
3	15:1892	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001704	MF-426
DOE/ER/53264–					
2	15:1928	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001721	MF-420
DOE/ER/53266–					
16	15:1893	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001481	MF-420
DOE/ER/60409–					
4	15:1424	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001488	MF-408
DOE/ER/60524–					
2	15:1441	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001524	MF-408
DOE/ER/60539–					
T2	15:1425	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001522	MF-408
DOE/ER/60636–					
T1	15:1426	NTIS, PC A03/MF A01; OSTI; INIS		DE90001453	MF-408
T3	15:1370	NTIS, PC A04/MF A01; OSTI; INIS		DE90001452	MF-408
DOE/ER/60674–					
2	15:1371	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002037	MF-408
DOE/ER/60686–					
1	15:1391	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002117	MF-408
DOE/FC/10628–					
2712-Vol.1	15:20	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000997	PC-103; PC-103
DOE/FTR–					
90001288	15:1116	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001288	MF-414
90001289	15:1117	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001289	MF-414
90001290	15:1118	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001290	MF-414
90001291	15:1119	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001291	MF-414
90001293	15:769	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001293	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/FTR–					
90001319	15:937	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001319	MF-401
90001320	15:243	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001320	MF-408
90001321	15:1389	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001321	MF-408
90001322	15:1395	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001322	MF-406
90001696	15:334	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001696	MF-400
90001697	15:1092	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001697	MF-414
90001698	15:1093	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001698	MF-414
90001702	15:1372	NTIS, PC A02/MF A01 - OSTI		DE90001702	MF-408
90001705	15:1120	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001705	MF-414
90001706	15:1121	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001706	MF-400
90001724	15:1427	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001724	MF-408
90001725	15:486	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001725	MF-400
90001726	15:1838	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001726	MF-400
90002426	15:959	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002426	MF-401
DOE/ID–					
10237	15:234	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002008	MF-225
DOE/ID/12356–					
1	15:235	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000985	MF-225
DOE/ID/12422–					
2	15:700	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001600	PC-311; PC-311
DOE/ID/12553–					
3	15:701	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001036	PC-311; PC-311
DOE/ID/12584–					
44	15:684	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002039	MF-511
DOE/LC/11066–					
2719-Vol.2	15:105	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011685	MF-123
2719-Vol.3	15:106	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011686	MF-123
DOE/MC/22042–					
15	15:52	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000774	PC-122
DOE/MC/23270–					
2751	15:657	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001934	MF-110
DOE/MC/23288–					
2742	15:4	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001105	MF-109
DOE/MC/24207–					
2748	15:30	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001703	MF-103
DOE/NE–					
0097	15:143	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000955	MF-512
DOE/OR/21389–					
22	15:231	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001915	MF-247
23	15:244	NTIS, PC A - OSTI; GPO Dep.	E 1.99:	DE90001933	MF-247
DOE/OR/21864–					
2	15:144	NTIS, PC A05/MF A01 - OSTI		DE90001932	MF-511
DOE/PC/71257–					
T18	15:5	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000642	PC-108; PC-108
DOE/PC/88653–					
T1	15:655	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001468	MF-112
DOE/PC/90533–					
9	15:6	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002247	MF-108
DOE/RL–					
88-27-Add.1	15:145	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002096	MF-510
88-27-Suppl.1	15:146	NTIS, PC A99/MF A01 - OSTI		DE90002099	MF-510
89-13	15:147	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001126	MF-511
DOE/RL/11396–					
1	15:1414	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002116	MF-500
T1	15:1415	NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001723	MF-500
DOE/SF/16667–					
T1	15:685	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90000632	MF-232
DOE/SF/17128–					
T1	15:1028	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016786	MF-706
DOE/SR/15199–					
2	15:1362	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001935	MF-700
DOE/SR/18049–					
1	15:1323	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002164	MF-702
DOE/SSDP–					
0053	15:203	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001657	MF-511
0082	15:487	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001658	MF-511
DPST–					
89-348	15:121	OSTI; GPO Dep.	E 1.99:	DE90001318	MF-701; MF-721

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DPT–					
128	15:488	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001718	MF-700
132	15:919	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001713	MF-701
E–					
4311	15:783	*See* N–89-19371			
4358	15:828	*See* N–89-17668			
4648	15:881	*See* N–89-21036			
4660	15:943	*See* N–89-19402			
4661	15:974	*See* N–89-19446			
4710	15:785	*See* N–89-25285			
4729	15:272	*See* N–89-23397			
4734	15:248	*See* N–89-26041			
4740	15:273	*See* N–89-24529			
4749	15:1053	*See* N–89-23818			
4804	15:285	*See* N–89-24438			
4808	15:277	*See* N–89-25269			
4815	15:1054	*See* N–89-23823			
4816	15:246	*See* N–89-23025			
4817	15:401	*See* N–89-25282			
4819	15:250	*See* N–89-26177			
4820	15:275	*See* N–89-25506			
4821	15:400	*See* N–89-25272			
4832	15:278	*See* N–89-25273			
4843	15:276	*See* N–89-24440			
4846	15:274	*See* N–89-25280			
4870	15:251	*See* N–89-26291			
4871	15:247	*See* N–89-24448			
4873	15:1084	*See* N–89-25490			
4902	15:742	*See* N–89-24593			
4913	15:253	*See* N–89-26799			
4921	15:252	*See* N–89-26292			
4984	15:990	*See* N–89-26044			
ECRC/M–					
2380	15:770	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
ECRC/R–					
2350	15:324	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
2373	15:325	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
2374	15:326	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
2375	15:327	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
2376	15:328	Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.			
EEO-ED–					
142/31	15:686	NTIS (US Sales Only), PC A03/MF A01		DE90713720	
144/140	15:705	NTIS (US Sales Only), PC A03/MF A01		DE90713739	
147/204	15:706	NTIS (US Sales Only), PC A03/MF A01		DE90713738	
181/167	15:707	NTIS (US Sales Only), PC A03/MF A01		DE90713736	
189/199	15:708	NTIS (US Sales Only), PC A03/MF A01		DE90713727	
190/216	15:225	NTIS (US Sales Only), PC A03/MF A01		DE90713735	
205/188	15:709	NTIS (US Sales Only), PC A06/MF A01		DE90713726	
206/228	15:687	NTIS (US Sales Only), PC A03/MF A01		DE90713729	
223/241	15:710	NTIS (US Sales Only), PC A03/MF A01		DE90713732	
229/317	15:711	NTIS (US Sales Only), PC A03/MF A01		DE90713728	
236/242	15:61	NTIS (US Sales Only), PC A03		DE90713731	
237/174	15:712	NTIS (US Sales Only), PC A03		DE90713730	
238/229	15:713	NTIS (US Sales Only), PC A04/MF A01		DE90713725	
239/210	15:232	NTIS (US Sales Only), PC A03/MF A01		DE90713737	
240/270	15:714	NTIS (US Sales Only), PC A03/MF A01		DE90713724	
245/208	15:715	NTIS (US Sales Only), PC A03		DE90713723	
251/291	15:688	NTIS (US Sales Only), PC A03/MF A01		DE90713722	
32/1	15:702	NTIS (US Sales Only), PC A03/MF A01		DE90713721	
40/98	15:703	NTIS (US Sales Only), PC A03/MF A01		DE90713734	
75	15:704	NTIS (US Sales Only), PC A03/MF A01		DE90713733	
EGG-BEG–					
8665	15:1543	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002022	MF-502; MF-506

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EGG-BNCT–					
8353-Vol.3-No.5	15:1428	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002077	MF-507
8353-Vol.3-No.6	15:1429	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016193	MF-408
8353-Vol.3-No.7	15:1430	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002149	MF-507
EGG-EP–					
8656	15:549	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002080	MF-331
EGG-ER–					
8623	15:1298	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002232	MF-502
EGG-ESE–					
8600	15:1282	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002229	MF-507
EGG-FSP–					
8678	15:1929	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002026	MF-424
8709	15:1930	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002148	MF-516
EGG-M–					
00688	15:1839	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002002	MF-507
88242	15:296	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002014	MF-257
88267	15:1931	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001997	MF-516
88287	15:111	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002093	MF-501; MF-502
88320	15:104	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002054	MF-123
88389	15:148	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002147	
88435	15:149	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002033	MF-512
89063	15:1318	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002057	MF-506; MF-510
89099	15:1884	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002079	MF-516
89181	15:21	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002072	MF-102
89187	15:489	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016195	MF-523
89202	15:1932	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002071	MF-516
89204	15:1933	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002041	MF-516
89206	15:1934	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002036	MF-516
89208	15:1935	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002040	MF-516
89213	15:1936	NTIS, PC A02/MF A01; OSTI; INSI; GPO Dep.	E 1.99:	DE90002051	MF-516
89214	15:1937	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002052	MF-516
89216	15:1938	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002056	MF-516
89235	15:7	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002048	MF-102
89237	15:8	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002035	MF-102
89239	15:1939	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002019	MF-422
89256	15:490	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016205	MF-520; MF-523
89279	15:1940	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002043	MF-516
89303	15:987	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002024	MF-820
89305	15:126	*See* GA-A–19701			
EGG-MS–					
8696	15:825	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002069	MF-113
EPA–					
450/3-88/013	15:1288	*See* PB–89-138002/XAB			
450/4-88/018	15:1289	*See* PB–89-139190/XAB			
520/5-89-008	15:1840	OSTI; INIS; US Environmental Protection Agency, 401 M St., SW, Washington, DC 20460		TI90001304	
530/SW-88/031S	15:1351	*See* PB–89-142533/XAB			
530/SW-89/067	15:739	*See* PB–89-230668/XAB			
530/UST-88/005	15:80	*See* PB–89-215164/XAB			
530/UST-88/006	15:81	*See* PB–89-215172/XAB			
530/UST-88/008	15:82	*See* PB–89-215180/XAB			
540/G-89/002	15:617	*See* PB–89-205934/XAB			
600/4-88/039	15:1337	*See* PB–89-220461/XAB			
600/4-89/001	15:1446	*See* PB–89-207013/XAB			
600/D-89/016	15:735	*See* PB–89-218168/XAB			
600/D-89/018	15:1357	*See* PB–89-218184/XAB			
600/D-89/020	15:1347	*See* PB–89-218259/XAB			
600/D-89/026	15:736	*See* PB–89-218267/XAB			
600/D-89/038	15:737	*See* PB–89-221394/XAB			
600/D-89/041	15:311	*See* PB–89-221378/XAB			
625/3-89/015	15:1462	*See* PB–89-220602/XAB			
905/9-89/001	15:1354	*See* PB–89-206023/XAB			
EPA/ROD/R–					
05-88/073	15:1358	*See* PB–89-225502/XAB			
09-88/020	15:1359	*See* PB–89-225551/XAB			
09-88/022	15:1360	*See* PB–89-225569/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EPRI-CU–					
6457	15:591	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6487	15:652	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-EL–					
6503	15:649	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-EN–					
6518-Vol.1	15:309	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-GS–					
6281	15:310	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6493	15:9	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6576	15:302	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-NP–					
6447	15:336	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6480-Vol.3	15:497	*See* NUREG/CR–5395-Vol.3			
6480-Vol.5	15:498	*See* NUREG/CR–5395-Vol.5			
6515-M	15:337	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6542	15:303	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6551	15:471	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-P–					
6552	15:592	Research Reports Center, Box 50490, Palo Alto, CA 94303			
ERIM–					
209700-2-T	15:1980	*See* AD-A–210176/4/XAB			
ESA-TT–					
1107	15:547	NTIS, PC A04/MF A01; original German version available from DFVLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, DM 29.50			
1120	15:1029	NTIS, PC A03/MF A01; original German version available from DFVLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, DM 15			
ETDE-IT–					
89-03	15:281	NTIS (US Sales Only), PC A02/MF A01		DE89793120	
ETN–					
89-94234	15:1029	*See* ESA-TT–1120			
89-94443	15:547	*See* ESA-TT–1107			
ETSU-N–					
106	15:299	British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
EUR–					
11799	15:771	NTIS (US Sales Only), PC A09/MF A01			
FDS–					
201/1988	15:741	Copy held by UB/TIB Hannover			
204/1988	15:694	Copy held by UB/TIB Hannover			
FERMILAB-PUB–					
88/170-A	15:1570	*See* N–89-17540			
89/110-A	15:1581	*See* N–89-25680			
89/111-A	15:1591	*See* N–89-26791			
89/113-A	15:1592	*See* N–89-26792			
89/119-A	15:1589	*See* N–89-26783			
89/122-A	15:1594	*See* N–89-26794			
89/83-A	15:1580	*See* N–89-25678			
FERMILAB-PUBL–					
88/187-A	15:1572	*See* N–89-18276			
FJSRL-TM–					
89-0003	15:548	*See* AD-A–210024/6/XAB			
FNAL-TM–					
1616	15:1163	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001872	PC-414
1617	15:1122	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001873	PC-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
FNAL-TM–					
1618	15:1123	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001877	PC-414
1619	15:1124	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001876	PC-414
FR–					
60071	15:888	*See* PB–89-216139/XAB			
FRCR–					
321	15:1893	*See* DOE/ER/53266–16			
FRNC-TH–					
3500	15:282	NTIS (US Sales Only), PC A07		DE90713664	
3507	15:283	NTIS (US Sales Only), PC A11		DE90713663	
3509	15:284	NTIS (US Sales Only), PC A08		DE90713662	
GA-A–					
19701	15:126	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014851	MF-820
GAO/RCED–					
89-6	15:66	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
89-37	15:77	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
89-43	15:650	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
89-61FS	15:127	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
GKSS–					
89/E/10	15:938	Preprint from: R.Y.M. Huang (ed.): Pervaporation membrane separation processes, chapter 12, Amsterdam (Netherlands), Elsevier (1989)			
89/E/14	15:1258	Special print from: J.M. Pacyna; B. Ottar (eds.): Control and fate of atmospheric trace metals, Kluwer, Dordrecht (Netherlands), p. 57-83 (1989)			
GRSJ–					
8901	15:292	NTIS (US Sales Only), PC A99/MF A01		DE89782365	
GSCAN-P–					
85-1B	15:1467	NTIS (US Sales Only), PC A99/MF A01		DE88780080	
GSF–					
15/88	15:150	NTIS (US Sales Only), PC A05/MF A01		DE90717905	
GSI–					
89-21	15:1894	NTIS (US Sales Only), PC A04/MF A01		DE90718236	
89-24	15:1895	NTIS (US Sales Only), PC A05/MF A01		DE90718235	
89-62(prepr.)	15:1879	Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			
89-63(prepr.)	15:1775	Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			
89-64(prepr.)	15:1800	Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			
89-67(prepr.)	15:1734	NTIS (US Sales Only), PC A03/MF A01		DE90718233	
89-68(prepr.)	15:1801	NTIS (US Sales Only), PC A03/MF A01		DE90718232	
HETA–					
86-381-1934	15:202	*See* PB–89-164735/XAB			
HW–					
26471	15:1431	NTIS, PC A02/MF A01 - OSTI		DE89015539	MF-600
IABG-TF–					
1950	15:772	NTIS (US Sales Only), PC A03/MF A01		DE90711185	
IAF–					
89-057	15:990	*See* N–89-26044			
IEA-SHAC-T–					
8.C.8	15:685	*See* DOE/SF/16667–T1			
IKF-IB–					
72	15:939	NTIS (US Sales Only), PC A05/MF A01		DE90717903	
INDC(JPN)–					
127/U	15:1808	*See* NEANDC(J)–140/U			
INIS-BR–					
1611	15:920	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90606121	
1624	15:1554	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90606044	
1628	15:1469	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606124	
1629	15:1470	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606125	
1630	15:1471	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606126	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1631	15:200	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606537	
1632	15:201	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606538	
1633	15:922	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606127	
1634	15:923	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606173	
1637	15:1472	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606120	
1645	15:960	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606221	
1653	15:924	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90606186	
1655	15:925	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606134	
1657	15:926	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606175	
1658	15:927	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606135	
1659	15:112	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606321	
1660	15:940	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606194	
1668	15:928	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE90606187	
1671	15:929	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606136	
1673	15:476	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606777	
1674	15:424	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606778	
1675	15:425	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606779	
1677	15:930	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90606137	
INIS-SU–					
10	15:426	NTIS (US Sales Only), PC A05/MF A01		DE88780094	
128	15:916	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90705935	
INIS-mf–					
11153	15:472	NTIS (US Sales Only), PC A04/MF A01		DE88780081	
11544	15:961	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE90705934	
12008	15:1236	NTIS (US Sales Only), PC A03/MF A01		DE90717907	
12009	15:1237	NTIS (US Sales Only), PC A06/MF A01		DE90717857	
12010	15:773	NTIS (US Sales Only), PC A05/MF A01		DE90717901	
12014	15:774	NTIS (US Sales Only), PC A13/MF A01		DE90717898	
12021	15:491	NTIS (US Sales Only), PC A02/MF A01		DE90718251	
12022	15:122	NTIS (US Sales Only), PC A16/MF A01		DE90717899	
IPEN-PUB–					
255	15:1434	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90606536	
258	15:931	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606140	
IRIM–					
8801	15:1871	NTIS (US Sales Only), PC A05/MF A01		DE89900733	
ISN–					
88-103	15:1164	NTIS (US Sales Only), PC A03/MF A01		DE90713769	
89-09	15:221	NTIS (US Sales Only), PC A04/MF A01		DE90713791	
89-12	15:1724	NTIS (US Sales Only), PC A03/MF A01		DE90713771	
IWS–					
051.02.09	15:1273	*See* PB–89-216063/XAB			
057.10	15:1411	*See* PB–89-216055/XAB			
057.13	15:1455	*See* PB–89-216022/XAB			
072.19	15:1272	*See* PB–89-215990/XAB			
072.20	15:1271	*See* PB–89-215982/XAB			
093.21	15:1270	*See* PB–89-215958/XAB			
095.11A	15:1454	*See* PB–89-215941/XAB			
095.14A	15:1456	*See* PB–89-216030/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
JA–					
6062	15:982	*See* AD-A–209960/4/XAB			
JINR-E–					
10-89-362	15:1165	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000714	
4-88-917	15:1735	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000523	
4-89-11	15:1736	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000116	
4-89-55	15:1803	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90000161	
6-89-413	15:1804	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000718	
9-89-324	15:1094	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000715	
JPL-PUBL–					
82-69-ADD-1	15:249	*See* N–89-26043			
88-31	15:1830	*See* N–89-20642			
JSES–					
8801	15:238	NTIS (US Sales Only), PC A14/MF A01		DE89900544	
Juel–					
2294	15:1781	NTIS (US Sales Only), PC A06/MF A01		DE90718150	
Juel-Conf–					
67	15:1166	NTIS (US Sales Only), PC A17/MF A01		DE90718173	
Juel-Spez–					
470	15:1063	Available from Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralbibliothek			
489	15:1147	Available from Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralbibliothek			
496	15:1125	NTIS (US Sales Only), PC A11/MF A01		DE90718174	
501	15:1725	Available from Kernforschungsanlage Juelich GmbH (Germany F.R.). Zentralbibliothek			
K/ITP–					
192	15:213	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001498	MF-515
KFA-IRW-TN–					
69/84	15:775	Copy held by UB/TIB Hannover			
KFK–					
4581	15:1941	NTIS (US Sales Only), PC A05/MF A01		DE90718225	
4593	15:492	NTIS (US Sales Only), PC A03/MF A01		DE90718098	
4601	15:826	NTIS (US Sales Only), PC A05/MF A01		DE90718101	
4602	15:1942	NTIS (US Sales Only), PC A06/MF A01		DE90718097	
KMSF-U–					
2116	15:1927	*See* DOE/DP/10560–6			
KWU-R–					
917/87/001	15:354	NTIS (US Sales Only), PC A10/MF A01		DE90718176	
L–					
11737	15:786	*See* N–89-26049			
16085	15:1031	*See* N–89-17855			
16512	15:1740	*See* N–89-17562			
16585	15:882	*See* N–89-25332			
LA–					
11510-MS-Pt.2	15:294	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001891	
11550-MS	15:293	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001388	
11592-T	15:827	Frank David Gac, Los Alamos National Laboratory, Los Alamos, NM 87545			ND-114
11633-MS	15:1073	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001427	
11659-M	15:1167	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002510	MF-700
11672-PR	15:1284	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001778	MF-907
11677-MS	15:1693	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001810	PC-701
11701-MS	15:1805	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002327	MF-700
LA-UR–					
89-2017	15:151	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014317	MF-706
89-2032	15:152	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014313	MF-721
89-2046	15:214	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014311	MF-700
89-2124	15:153	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014225	MF-714
89-2207	15:1798	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014271	MF-413
89-2209	15:1806	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014270	MF-413
89-2210	15:1776	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014469	MF-413
89-2418	15:457	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015256	MF-731
89-2607	15:1988	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016607	MF-705
89-2913	15:1943	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016610	MF-427
89-3000	15:1221	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000536	MF-741
89-3001	15:875	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000541	
89-3002	15:876	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000540	
89-3008	15:1852	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000537	MF-910
89-3043	15:1944	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002358	MF-424
89-3111	15:1095	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001831	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-3116	15:154	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001830	MF-814
89-3124	15:1568	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001827	MF-414
89-3135	15:777	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001235	MF-704
89-3171	15:215	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000695	MF-706
89-3210	15:155	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000198	MF-814
89-3232	15:1373	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000687	MF-908
89-3233	15:1945	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002357	MF-424
89-3261	15:1946	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002356	MF-426
89-3262	15:1947	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002355	MF-420
89-3265	15:1402	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000680	
89-3271	15:1948	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002353	MF-424
89-3276	15:1949	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002351	MF-424
89-3279	15:1950	NTIS, PC A03/MF A01; OSTI; INIS		DE90002348	MF-424
89-3280	15:1951	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002347	MF-424
89-3281	15:1952	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002346	MF-425
89-3291	15:1953	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002448	MF-424
89-3293	15:1954	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002446	MF-426
89-3298	15:1955	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002444	MF-424
89-3299	15:1956	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002443	MF-420
89-3301	15:877	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000678	MF-904; MF-906
89-3310	15:1569	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001236	MF-706; MF-705
89-3322	15:1957	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002442	MF-420
89-3327	15:1901	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002441	MF-424
89-3336	15:1872	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002438	MF-411
89-3352	15:1958	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002435	MF-424
89-3353	15:1959	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002434	MF-424
89-3382	15:1960	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002392	MF-420
89-3383	15:1961	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002391	MF-420
89-3426	15:1737	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002383	MF-414
89-3482	15:1962	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002406	MF-424
89-3486	15:1030	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002405	
89-3499	15:1873	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002403	MF-410; MF-404
89-3534	15:1126	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002399	MF-414
89-3560	15:1148	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002415	MF-405
89-3576	15:1880	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002413	MF-905; MF-910
89-3596	15:1127	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002410	MF-414
89-3609	15:1738	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002419	MF-413
LAPP-EXP–					
88-09	15:776	NTIS (US Sales Only), PC A02/MF A01		DE90713780	
88-11	15:1726	NTIS (US Sales Only), PC A03/MF A01		DE90713781	
88-18	15:1168	NTIS (US Sales Only), PC A03/MF A01		DE90713764	
LBL–					
26321	15:1169	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001424	MF-406
26499	15:1214	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001420	MF-408
26612-Vol.3	15:297	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002459	MF-251
27004	15:1096	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001542	MF-414
27249	15:778	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000167	MF-404
27377	15:779	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002331	MF-404
27378	15:780	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002083	MF-404
27428	15:156	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002330	MF-402; MF-405
27563	15:781	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001568	MF-404
27617	15:1807	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000551	MF-413
27638	15:1435	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001140	MF-408
27661	15:878	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002122	MF-406
27663	15:1128	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002329	MF-414
27668	15:1215	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001141	MF-404
27691	15:1788	NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002685	MF-414
27728	15:1436	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001540	MF-408
27821	15:1989	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002333	MF-405
8678-Rev.3	15:689	NTIS, PC A99/MF A01; OSTI; Order software packages fron National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE89017727	MF-350; PC-350

LBL–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
8688-Rev.5	15:690	NTIS, PC A07/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE89017726	MF-350; PC-350
8706-Suppl.-Rev.5	15:691	NTIS, PC A21/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE89017728	MF-350; PC-350
LCCCN–					
88-607933	15:624	*See* PB–89-214928/XAB			
LIR–					
01-89/337	15:1333	*See* PB–89-217145/XAB			
LMSC-F–					
352227	15:752	*See* AD-A–209934/9/XAB			
LMSC-HEC-TR-F–					
268519	15:1083	*See* N–89-24433			
LPI-CONTRIB–					
673	15:1473	*See* N–89-21287			
LR–					
615(PA)M	15:1264	*See* PB–89-197925/XAB			
630(CS)M	15:1447	*See* PB–89-212377/XAB			
634(AP)M	15:1263	*See* PB–89-197917/XAB			
662(AP)M	15:1265	*See* PB–89-198337/XAB			
MISC–					
89083	15:234	*See* DOE/ID–10237			
MPI-PAE/Exp.El.–					
200	15:1170	Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik			
208	15:1171	NTIS (US Sales Only), PC A08/MF A01		DE90718239	
211	15:1739	NTIS (US Sales Only), PC A03/MF A01		DE90718231	
MS–					
8260	15:983	*See* AD-A–209965/3/XAB			
N–					
89-17445	15:1717	NTIS, PC A03/MF A01			
89-17530	15:879	NTIS, PC A03/MF A01			
89-17540	15:1570	NTIS, PC A02/MF A01			
89-17558	15:1571	NTIS, PC A03/MF A01			
89-17562	15:1740	NTIS, PC A05/MF A01			
89-17668	15:828	NTIS, PC A02/MF A01			
89-17855	15:1031	NTIS, PC A03/MF A01			
89-17856	15:1032	NTIS, PC A04/MF A01			
89-17941	15:397	NTIS, PC A03/MF A01			
89-17959	15:1259	NTIS, PC A04/MF A01			
89-18276	15:1572	NTIS, PC A03/MF A01			
89-18375	15:1575	NTIS, PC A10/MF A01			
89-18376	15:1576	NTIS, PC A02/MF A01			
89-18526	15:973	NTIS, PC A08/MF A01			
89-18528	15:782	NTIS, PC A07/MF A01			
89-18550	15:829	NTIS, PC A03/MF A01			
89-18679	15:329	NTIS, PC A03/MF A01			
89-18967	15:398	NTIS, PC A06/MF A01			
89-19371	15:783	NTIS, PC A03/MF A01			
89-19402	15:943	NTIS, PC A03/MF A01			
89-19446	15:974	NTIS, PC A02/MF A01			
89-20218	15:975	NTIS, PC A03/MF A01			
89-20248	15:988	NTIS, PC A04/MF A01			
89-20642	15:1830	NTIS, PC A09/MF A01			
89-20820	15:880	NTIS, PC A03/MF A01			
89-21036	15:881	NTIS, PC A03/MF A01			
89-21191	15:1052	NTIS, PC A04/MF A01			
89-21287	15:1473	NTIS, PC A11/MF A01			
89-22980	15:399	NTIS, PC A07/MF A01			
89-23025	15:246	NTIS, PC A02/MF A01			
89-23397	15:272	NTIS, PC A02/MF A01			
89-23678	15:830	NTIS, PC A04/MF A01			
89-23818	15:1053	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-23823	15:1054	NTIS, PC A03/MF A01			
89-24240	15:1577	NTIS, PC A02/MF A01			
89-24433	15:1083	NTIS, PC A03/MF A01			
89-24438	15:285	NTIS, PC A02/MF A01			
89-24440	15:276	NTIS, PC A02/MF A01			
89-24448	15:247	NTIS, PC A02/MF A01			
89-24529	15:273	NTIS, PC A03/MF A01			
89-24578	15:1055	NTIS, PC A03/MF A01			
89-24593	15:742	NTIS, PC A02/MF A01			
89-24889	15:1694	NTIS, PC A03/MF A01			
89-25099	15:1578	NTIS, PC A03/MF A01			
89-25269	15:277	NTIS, PC A03/MF A01			
89-25272	15:400	NTIS, PC A03/MF A01			
89-25273	15:278	NTIS, PC A02/MF A01			
89-25280	15:274	NTIS, PC A03/MF A01			
89-25282	15:401	NTIS, PC A03/MF A01			
89-25285	15:785	NTIS, PC A03/MF A01			
89-25332	15:882	NTIS, PC A03/MF A01			
89-25433	15:222	NTIS, PC A03/MF A01			
89-25490	15:1084	NTIS, PC A03/MF A01			
89-25506	15:275	NTIS, PC A02/MF A01			
89-25541	15:1579	NTIS, PC A04/MF A01			
89-25678	15:1580	NTIS, PC A03/MF A01			
89-25680	15:1581	NTIS, PC A03/MF A01			
89-25746	15:883	NTIS, PC A03/MF A01			
89-25777	15:1582	NTIS, PC A03/MF A01			
89-25780	15:1583	NTIS, PC A03/MF A01			
89-25945	15:1584	NTIS, PC A07/MF A01			
89-26041	15:248	NTIS, PC A03/MF A01			
89-26043	15:249	NTIS, PC A03/MF A01			
89-26044	15:990	NTIS, PC A03/MF A01			
89-26049	15:786	NTIS, PC A03/MF A01			
89-26177	15:250	NTIS, PC A02/MF A01			
89-26184	15:1056	NTIS, PC A03/MF A01			
89-26198	15:884	NTIS, PC A03/MF A01			
89-26220	15:1033	NTIS, PC A03/MF A01			
89-26291	15:251	NTIS, PC A02/MF A01			
89-26292	15:252	NTIS, PC A02/MF A01			
89-26300	15:1585	NTIS, PC A03/MF A01			
89-26308	15:1586	NTIS, PC A03/MF A01			
89-26629	15:1172	NTIS, PC A02/MF A01			
89-26684	15:944	NTIS, PC A03/MF A01			
89-26685	15:945	NTIS, PC A02/MF A01			
89-26720	15:1902	NTIS, PC A99/MF E03			
89-26721	15:1903	NTIS, PC A11/MF A01			
89-26722	15:1904	NTIS, PC A21/MF A01			
89-26727	15:1688	NTIS, PC A04/MF A01			
89-26739	15:885	NTIS, PC A03/MF A01			
89-26740	15:886	NTIS, PC A03/MF A01			
89-26741	15:946	NTIS, PC A03/MF A01			
89-26783	15:1589	NTIS, PC A03/MF A01			
89-26784	15:1590	NTIS, PC A03/MF A01			
89-26787	15:1173	NTIS, PC A03/MF A01			
89-26791	15:1591	NTIS, PC A03/MF A01			
89-26792	15:1592	NTIS, PC A03/MF A01			
89-26793	15:1593	NTIS, PC A03/MF A01			
89-26794	15:1594	NTIS, PC A03/MF A01			
89-26795	15:1595	NTIS, PC A03/MF A01			
89-26799	15:253	NTIS, PC A03/MF A01			
NAL-TR–					
960	15:977	NTIS (US Sales Only), PC A04/MF A01		DE89900737	
987	15:695	NTIS (US Sales Only), PC A03/MF A01		DE89900735	
NAS–					
1.15:100349	15:1571	*See* N–89-17558			
1.15:100350	15:879	*See* N–89-17530			
1.15:100371	15:946	*See* N–89-26741			
1.15:100739	15:1172	*See* N–89-26629			
1.15:101340	15:828	*See* N–89-17668			
1.15:101506	15:782	*See* N–89-18528			
1.15:101529	15:329	*See* N–89-18679			
1.15:101590	15:222	*See* N–89-25433			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1.15:101788	15:1593	*See* N–89-26793			
1.15:101792	15:1583	*See* N–89-25780			
1.15:101954	15:783	*See* N–89-19371			
1.15:101962	15:943	*See* N–89-19402			
1.15:101963	15:974	*See* N–89-19446			
1.15:102004	15:785	*See* N–89-25285			
1.15:102015	15:272	*See* N–89-23397			
1.15:102017	15:248	*See* N–89-26041			
1.15:102052	15:285	*See* N–89-24438			
1.15:102055	15:277	*See* N–89-25269			
1.15:102057	15:1054	*See* N–89-23823			
1.15:102058	15:246	*See* N–89-23025			
1.15:102059	15:401	*See* N–89-25282			
1.15:102062	15:250	*See* N–89-26177			
1.15:102063	15:275	*See* N–89-25506			
1.15:102064	15:400	*See* N–89-25272			
1.15:102073	15:278	*See* N–89-25273			
1.15:102075	15:273	*See* N–89-24529			
1.15:102081	15:276	*See* N–89-24440			
1.15:102083	15:274	*See* N–89-25280			
1.15:102104	15:251	*See* N–89-26291			
1.15:102105	15:247	*See* N–89-24448			
1.15:102106	15:1084	*See* N–89-25490			
1.15:102121	15:742	*See* N–89-24593			
1.15:102127	15:253	*See* N–89-26799			
1.15:102131	15:252	*See* N–89-26292			
1.15:102303	15:990	*See* N–89-26044			
1.20:127	15:1577	*See* N–89-24240			
1.26:177512	15:1717	*See* N–89-17445			
1.26:179614-VOL-1	15:397	*See* N–89-17941			
1.26:179614-VOL-3	15:399	*See* N–89-22980			
1.26:179614-VOL-4	15:398	*See* N–89-18967			
1.26:179645	15:829	*See* N–89-18550			
1.26:181277	15:945	*See* N–89-26685			
1.26:181450	15:1572	*See* N–89-18276			
1.26:181776	15:1052	*See* N–89-21191			
1.26:181777	15:786	*See* N–89-26049			
1.26:182260	15:881	*See* N–89-21036			
1.26:182285	15:1053	*See* N–89-23818			
1.26:182895	15:944	*See* N–89-26684			
1.26:182957	15:1259	*See* N–89-17959			
1.26:183329	15:1473	*See* N–89-21287			
1.26:183420	15:884	*See* N–89-26198			
1.26:183639	15:1083	*See* N–89-24433			
1.26:183697	15:1903	*See* N–89-26721			
1.26:183698	15:1904	*See* N–89-26722			
1.26:183699	15:1902	*See* N–89-26720			
1.26:184663	15:973	*See* N–89-18526			
1.26:184684	15:1586	*See* N–89-26308			
1.26:184762	15:1576	*See* N–89-18376			
1.26:184763	15:1575	*See* N–89-18375			
1.26:184772	15:1570	*See* N–89-17540			
1.26:184790	15:1032	*See* N–89-17856			
1.26:184798	15:830	*See* N–89-23678			
1.26:184819	15:988	*See* N–89-20248			
1.26:184840	15:880	*See* N–89-20820			
1.26:184844	15:975	*See* N–89-20218			
1.26:184869	15:1830	*See* N–89-20642			
1.26:184950	15:1694	*See* N–89-24889			
1.26:184951	15:1578	*See* N–89-25099			
1.26:185029	15:1592	*See* N–89-26792			
1.26:185030	15:1580	*See* N–89-25678			
1.26:185041	15:1591	*See* N–89-26791			
1.26:185051	15:1582	*See* N–89-25777			
1.26:185333	15:1585	*See* N–89-26300			
1.26:185345	15:1595	*See* N–89-26795			
1.26:185348	15:1590	*See* N–89-26784			
1.26:185350	15:1594	*See* N–89-26794			
1.26:185351	15:1581	*See* N–89-25680			
1.26:185352	15:1589	*See* N–89-26783			
1.26:185372	15:883	*See* N–89-25746			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1.26:185389	15:1584	*See* N–89-25945			
1.26:185390	15:1033	*See* N–89-26220			
1.26:185405	15:1055	*See* N–89-24578			
1.26:185435	15:1579	*See* N–89-25541			
1.26:185438	15:1173	*See* N–89-26787			
1.26:185439	15:886	*See* N–89-26740			
1.26:185440	15:885	*See* N–89-26739			
1.26:185449	15:1688	*See* N–89-26727			
1.26:185465	15:249	*See* N–89-26043			
1.55:3043	15:1056	*See* N–89-26184			
1.60:2887	15:1740	*See* N–89-17562			
1.60:2905	15:1031	*See* N–89-17855			
1.60:2928	15:882	*See* N–89-25332			
NASA-CP–					
3043	15:1056	*See* N–89-26184			
NASA-CR–					
177512	15:1717	*See* N–89-17445			
179614-VOL-1	15:397	*See* N–89-17941			
179614-VOL-3	15:399	*See* N–89-22980			
179614-VOL-4	15:398	*See* N–89-18967			
179645	15:829	*See* N–89-18550			
181277	15:945	*See* N–89-26685			
181450	15:1572	*See* N–89-18276			
181776	15:1052	*See* N–89-21191			
181777	15:786	*See* N–89-26049			
182260	15:881	*See* N–89-21036			
182285	15:1053	*See* N–89-23818			
182895	15:944	*See* N–89-26684			
182957	15:1259	*See* N–89-17959			
183329	15:1473	*See* N–89-21287			
183420	15:884	*See* N–89-26198			
183639	15:1083	*See* N–89-24433			
183697	15:1903	*See* N–89-26721			
183698	15:1904	*See* N–89-26722			
183699	15:1902	*See* N–89-26720			
184663	15:973	*See* N–89-18526			
184684	15:1586	*See* N–89-26308			
184762	15:1576	*See* N–89-18376			
184763	15:1575	*See* N–89-18375			
184772	15:1570	*See* N–89-17540			
184790	15:1032	*See* N–89-17856			
184798	15:830	*See* N–89-23678			
184819	15:988	*See* N–89-20248			
184840	15:880	*See* N–89-20820			
184844	15:975	*See* N–89-20218			
184869	15:1830	*See* N–89-20642			
184950	15:1694	*See* N–89-24889			
184951	15:1578	*See* N–89-25099			
185029	15:1592	*See* N–89-26792			
185030	15:1580	*See* N–89-25678			
185041	15:1591	*See* N–89-26791			
185051	15:1582	*See* N–89-25777			
185333	15:1585	*See* N–89-26300			
185345	15:1595	*See* N–89-26795			
185348	15:1590	*See* N–89-26784			
185350	15:1594	*See* N–89-26794			
185351	15:1581	*See* N–89-25680			
185352	15:1589	*See* N–89-26783			
185372	15:883	*See* N–89-25746			
185389	15:1584	*See* N–89-25945			
185390	15:1033	*See* N–89-26220			
185405	15:1055	*See* N–89-24578			
185435	15:1579	*See* N–89-25541			
185438	15:1173	*See* N–89-26787			
185439	15:886	*See* N–89-26740			
185440	15:885	*See* N–89-26739			
185449	15:1688	*See* N–89-26727			
185465	15:249	*See* N–89-26043			
NASA-NF–					
127	15:1577	*See* N–89-24240			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NASA-TM–					
100349	15:1571	*See* N–89-17558			
100350	15:879	*See* N–89-17530			
100371	15:946	*See* N–89-26741			
100739	15:1172	*See* N–89-26629			
101340	15:828	*See* N–89-17668			
101506	15:782	*See* N–89-18528			
101529	15:329	*See* N–89-18679			
101590	15:222	*See* N–89-25433			
101788	15:1593	*See* N–89-26793			
101792	15:1583	*See* N–89-25780			
101954	15:783	*See* N–89-19371			
101962	15:943	*See* N–89-19402			
101963	15:974	*See* N–89-19446			
102004	15:785	*See* N–89-25285			
102015	15:272	*See* N–89-23397			
102017	15:248	*See* N–89-26041			
102052	15:285	*See* N–89-24438			
102055	15:277	*See* N–89-25269			
102057	15:1054	*See* N–89-23823			
102058	15:246	*See* N–89-23025			
102059	15:401	*See* N–89-25282			
102062	15:250	*See* N–89-26177			
102063	15:275	*See* N–89-25506			
102064	15:400	*See* N–89-25272			
102073	15:278	*See* N–89-25273			
102075	15:273	*See* N–89-24529			
102081	15:276	*See* N–89-24440			
102083	15:274	*See* N–89-25280			
102104	15:251	*See* N–89-26291			
102105	15:247	*See* N–89-24448			
102106	15:1084	*See* N–89-25490			
102121	15:742	*See* N–89-24593			
102127	15:253	*See* N–89-26799			
102131	15:252	*See* N–89-26292			
102303	15:990	*See* N–89-26044			
NASA-TP–					
2887	15:1740	*See* N–89-17562			
2905	15:1031	*See* N–89-17855			
2928	15:882	*See* N–89-25332			
NBS/TN–					
1321	15:1035	*See* PB–89-193908/XAB			
NCAR/TN–					
326+STR	15:1601	*See* PB–89-163695/XAB			
NDP–					
032	15:1239	*See* ORNL/CDIAC–27			
NEANDC(J)–					
140/U	15:1808	Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai-mura, Ibaraki-ken, Japan			
NEDO–					
P-8715	15:295	NTIS (US Sales Only), PC A18/MF A01		DE89782628	
NIST/TN–					
1257	15:932	*See* PB–89-168017/XAB			
NISTIR–					
89-4167	15:331	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001751	MF-220
89/3914	15:889	*See* PB–89-218358/XAB			
89/4112	15:1064	*See* PB–89-228274/XAB			
89/4126	15:692	*See* PB–89-229686/XAB			
NMRI–					
89-24	15:1417	*See* AD-A–209663/4/XAB			
NOAA-TM-ERL-ARL–					
173	15:1266	*See* PB–89-212336/XAB			
NRL-MR–					
6463	15:1022	*See* AD-A–209740/0/XAB			
6466	15:1149	*See* AD-A–209720/2/XAB			
6467	15:1150	*See* AD-A–209721/0/XAB			
6468	15:1151	*See* AD-A–209722/8/XAB			
6469	15:1152	*See* AD-A–209723/6/XAB			
6481	15:1618	*See* AD-A–209993/5/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NRTC–					
88-22-R	15:1210	*See* AD-A–210165/7/XAB			
NTP-TR–					
349	15:1458	*See* PB–89-216535/XAB			
NTSB/RAR–					
89/04	15:697	*See* PB–89-916304/XAB			
NUKEM-FuE–					
88019	15:157	NTIS (US Sales Only), PC A03/MF A01		DE90717906	
NUREG–					
1385	15:403	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90001305	
NUREG/BR–					
0121	15:158	OSTI; INIS; Division of Low-Level Waste Management and Decommissioning, Mail Stop 5E4, Office of Nuclear Material Safety and Safeguards, Washington, DC 20555		TI90000092	
NUREG/CP–					
0102-Vol.2	15:493	NTIS, PC A21/MF A01 - GPO; OSTI; INIS		TI90001362	
0104	15:494	NTIS, PC A09/MF A01 - GPO; OSTI; INIS		TI90000746	
NUREG/CR–					
1754-Add.1	15:495	NTIS, PC A10/MF A01 - GPO; OSTI; INIS		TI90001370	
4735-Vol.5	15:160	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI90001583	
5079	15:355	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90002109	
5098	15:496	NTIS, PC A13/MF A01 - GPO; OSTI; INIS		TI90001371	
5365	15:356	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90001479	
5395-Vol.3	15:497	NTIS, PC A17/MF A01 - GPO; OSTI; INIS		TI90001586	
5395-Vol.5	15:498	NTIS, PC E10/MF E01 - GPO; OSTI; INIS		TI90001685	
5429-Vol.1	15:161	NTIS, PC A10/MF A01 - GPO - OSTI		TI90001582	
5429-Vol.3	15:162	NTIS, PC A09/MF A01 - GPO - OSTI		TI90001584	
ORNL–					
6526/R7	15:1299	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000961	MF-630
6526/R8	15:1300	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000962	MF-630
6565	15:696	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000963	MF-330
6569	15:63	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000964	
6570	15:78	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000965	
6573	15:338	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000966	MF-406
ORNL/CDIAC–					
27	15:1239	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000971	MF-402
ORNL/CON–					
289	15:653	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001850	MF-920
ORNL/FTR–					
2908	15:10	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001741	MF-106
2918	15:1963	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001742	MF-420
2920	15:1964	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001743	MF-420
2933	15:382	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001744	MF-522
2941	15:383	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001746	MF-522
2950	15:1965	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001745	MF-420
2954	15:831	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001747	MF-406
2972	15:787	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001748	MF-350
3010	15:1966	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002125	MF-423
3031	15:1967	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001299	MF-423
3066	15:832	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002138	MF-401
3067	15:1874	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001301	MF-404; MF-405
3068	15:788	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001302	MF-404; MF-406
3090	15:1174	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001283	MF-406
3096	15:833	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001285	MF-406
3097	15:834	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001282	MF-336
3156	15:835	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002144	MF-404
3176	15:384	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002140	MF-522
3180	15:789	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002141	MF-406
3186	15:385	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002143	MF-522
3245	15:790	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002145	MF-401
3379	15:791	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001497	MF-404
3397	15:792	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001496	MF-404
3398	15:1416	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001539	MF-403
3400	15:793	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001245	MF-404; MF-401
3402	15:1285	NTIS, PC A03/MF A01 - OSTI		DE90001493	MF-402
3403	15:1261	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001396	MF-600
3405	15:1175	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001545	MF-405

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/FTR–					
3406	15:1991	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001590	
3411	15:1301	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001294	MF-402
3416	15:1034	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001538	MF-406
3418	15:794	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001494	MF-404
3421	15:1968	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001712	MF-420
3422	15:1853	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001296	MF-404
ORNL/M–					
785	15:1442	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002151	
966	15:732	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001287	MF-702
ORNL/RASA–					
87/32	15:1308	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001560	MF-511
87/33	15:1309	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001486	MF-511
87/35	15:1310	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002130	MF-507; MF-511
88/25	15:1311	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001589	MF-511
88/39	15:1312	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002134	MF-507; MF-511
88/51	15:1313	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001280	MF-507; MF-511
88/55	15:1314	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002131	MF-507; MF-511
88/56	15:1315	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002129	MF-507; MF-511
88/58	15:1316	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002133	MF-507; MF-511
ORNL/Sub–					
85-22012/1	15:332	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000973	MF-221
85-27488/04	15:305	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002128	MF-114
86-57444/01	15:836	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001277	MF-114
86-SA094/3	15:163	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001846	MF-812
87-SB064/1	15:716	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000980	MF-202
88-SC924/1	15:164	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001845	MF-721
ORNL/TM–					
11168	15:356	*See* NUREG/CR–5365			
11194	15:1443	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001849	MF-702
11214	15:1262	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001857	
11286	15:165	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001854	MF-721
11294	15:1302	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000982	PC-403
11309	15:477	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000992	MF-400
11311	15:499	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001859	MF-400
11318	15:991	NTIS, PC A03/MF A01 - OSTI		DE90001360	MF-400
ORNL/tr–					
89-47	15:887	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001581	MF-404
89/41	15:427	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002283	MF-406
89/43	15:386	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001483	MF-520
89/44	15:387	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001484	MF-520
89/45	15:388	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001485	MF-520
OTA-BP-O–					
54	15:738	*See* PB–89-223291/XAB			
PATENTS-USA–					
4,846,964	15:14	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,931	15:15	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,847,008	15:197	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,842,774	15:198	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,765	15:199	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,903	15:229	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,904	15:233	Patent and Trademark Office, Box 9, Washington, DC 20232			
7-326,776	15:333	NTIS, PC A03/MF A01			
4,831,965	15:672	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,226	15:729	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,831,846	15:1015	Patent and Trademark Office, Box 9, Washington, DC 20232			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4,839,339	15:1016	Patent and Trademark Office, Box 9, Washington, DC 20232			
7-355,582	15:1017	NTIS, PC A03/MF A01			
4,791,630	15:1046	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,791,633	15:1047	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,841,778	15:1078	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,841,621	15:1079	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,838,644	15:1080	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,778,116	15:1081	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,837,936	15:1343	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,838,098	15:1349	Patent and Trademark Office, Box 9, Washington, DC 20232			
PB–					
89-138002/XAB	15:1288	NTIS, PC A03/MF A01			
89-139190/XAB	15:1289	NTISMF A01			
89-139323/XAB	15:53	NTIS, PC A15/MF A01			
89-142533/XAB	15:1351	NTIS, PC A06/MF A01			
89-158323/XAB	15:1596	NTIS, PC A06/MF A01			
89-158331/XAB	15:1597	NTIS, PC A04/MF A01			
89-158349/XAB	15:1598	NTIS, PC A08/MF A01			
89-160873/XAB	15:11	NTIS, PC A05/MF A01			
89-162481/XAB	15:1599	NTIS, PC A07/MF A01			
89-162499/XAB	15:1600	NTIS, PC A05/MF A01			
89-163695/XAB	15:1601	NTIS, PC A05/MF A01			
89-164735/XAB	15:202	NTIS, PC A03/MF A01			
89-165534/XAB	15:31	NTIS, PC A07/MF A01			
89-168017/XAB	15:932	NTIS, PC A11/MF A01			
89-172266/XAB	15:32	NTIS, PC A06/MF A01			
89-173694/XAB	15:102	NTIS, PC A06/MF A01			
89-175442/XAB	15:1352	NTIS, PC A03/MF A01			
89-177539/XAB	15:992	NTIS, PC EE05/MF E05			
89-178248/XAB	15:1324	NTIS, PC A14/MF A01			
89-178776/XAB	15:227	NTIS, PC A06/MF A01			
89-179030/XAB	15:733	NTIS, PC A14/MF A01			
89-193908/XAB	15:1035	NTIS, PC A03/MF A01			
89-196885/XAB	15:67	NTISMF A01			
89-196927/XAB	15:620	NTISMF A01			
89-197727/XAB	15:1444	NTIS, PC A02/MF A01			
89-197917/XAB	15:1263	NTIS, PC EE06/MF E06			
89-197925/XAB	15:1264	NTIS, PC EE05/MF E05			
89-198337/XAB	15:1265	NTIS, PC EE05/MF E05			
89-201404/XAB	15:933	NTIS, PC A03/MF A01			
89-202402/XAB	15:1346	NTIS, PC A03/MF A01			
89-203319/XAB	15:1445	NTIS, PC A21/MF A01			
89-203616/XAB	15:1330	NTIS, PC A14/MF A01			
89-204465/XAB	15:1392	NTIS, PC A23/MF A01			
89-205934/XAB	15:617	NTIS, PC A03/MF A01			
89-205967/XAB	15:1353	NTIS, PC A14/MF A01			
89-206023/XAB	15:1354	NTIS, PC A05/MF A01			
89-207013/XAB	15:1446	NTIS, PC A12/MF A01			
89-209605/XAB	15:621	NTIS, PC EE06/MF E06			
89-211726/XAB	15:1355	NTIS, PC A05/MF A01			
89-211734/XAB	15:1356	NTIS, PC A11/MF A01			
89-211767/XAB	15:618	NTIS, PC A06/MF A01			
89-212278/XAB	15:1290	NTIS, PC A04/MF A01			
89-212286/XAB	15:734	NTIS, PC A04/MF A01			
89-212336/XAB	15:1266	NTIS, PC A07/MF A01			
89-212377/XAB	15:1447	NTIS, PC EE04/MF E04			
89-212435/XAB	15:1992	NTIS, PC EE05/MF E05			
89-212757/XAB	15:1321	NTIS, PC A05/MF A01			
89-213433/XAB	15:717	NTIS, PC A06/MF A01			
89-214027/XAB	15:1267	NTIS, PC A10/MF A01			
89-214142/XAB	15:1268	NTIS, PC A18/MF A01			
89-214217/XAB	15:622	NTIS, PC A04/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-214225/XAB	15:746	NTIS, PC A21/MF A01			
89-214472/XAB	15:1331	NTIS, PC A07/MF A01			
89-214878/XAB	15:623	NTIS, PC A07/MF A01			
89-214894/XAB	15:1332	NTIS, PC A04/MF A01			
89-214928/XAB	15:624	NTIS, PC A03/MF A01			
89-214936/XAB	15:651	NTIS, PC A11/MF A01			
89-214951/XAB	15:1365	NTIS, PC A08/MF A01			
89-215164/XAB	15:80	NTIS, PC A03/MF A01			
89-215172/XAB	15:81	NTIS, PC A03/MF A01			
89-215180/XAB	15:82	NTIS, PC A03/MF A01			
89-215461/XAB	15:1602	NTIS, PC A03/MF A01			
89-215768/XAB	15:1403	NTIS, PC A05/MF A01			
89-215784/XAB	15:1448	NTIS, PC A05/MF A01			
89-215792/XAB	15:1449	NTIS, PC A04/MF A01			
89-215818/XAB	15:1450	NTIS, PC A08/MF A01			
89-215826/XAB	15:1451	NTIS, PC A06/MF A01			
89-215834/XAB	15:1452	NTIS, PC A04/MF A01			
89-215842/XAB	15:1453	NTIS, PC A05/MF A01			
89-215859/XAB	15:1269	NTIS, PC A03/MF A01			
89-215941/XAB	15:1454	NTIS, PC A02/MF A01			
89-215958/XAB	15:1270	NTIS, PC A02/MF A01			
89-215982/XAB	15:1271	NTIS, PC A03/MF A01			
89-215990/XAB	15:1272	NTIS, PC A03/MF A01			
89-216022/XAB	15:1455	NTIS, PC A02/MF A01			
89-216030/XAB	15:1456	NTIS, PC A02/MF A01			
89-216055/XAB	15:1411	NTIS, PC A02/MF A01			
89-216063/XAB	15:1273	NTIS, PC A03/MF A01			
89-216105/XAB	15:647	NTIS, PC A04/MF A01			
89-216139/XAB	15:888	NTIS, PC A03/MF A01			
89-216162/XAB	15:1695	NTIS, PC A06/MF A01			
89-216196/XAB	15:993	NTIS, PC A03/MF A01			
89-216220/XAB	15:1457	NTIS, PC A07/MF A01			
89-216535/XAB	15:1458	NTIS, PC A12/MF A01			
89-216618/XAB	15:1459	NTIS, PC A07/MF A01			
89-216626/XAB	15:28	NTIS, PC A03/MF A01			
89-216642/XAB	15:1460	NTIS, PC A07/MF A01			
89-216667/XAB	15:718	NTIS, PC A03/MF A01			
89-217095/XAB	15:994	NTIS, PC EE05/MF A01			
89-217145/XAB	15:1333	NTIS, PC A03/MF A01			
89-217210/XAB	15:625	NTISMF E10			
89-217566/XAB	15:1334	NTIS, PC A03/MF A01			
89-217608/XAB	15:604	NTIS, PC A09/MF A01			
89-217616/XAB	15:605	NTIS, PC A12/MF A01			
89-217624/XAB	15:606	NTIS, PC A12/MF A01			
89-217632/XAB	15:607	NTIS, PC A12/MF A01			
89-217640/XAB	15:608	NTIS, PC A08/MF A01			
89-217657/XAB	15:609	NTIS, PC A11/MF A01			
89-217665/XAB	15:610	NTIS, PC A12/MF A01			
89-217673/XAB	15:611	NTIS, PC A12/MF A01			
89-217681/XAB	15:612	NTIS, PC A14/MF A01			
89-217699/XAB	15:613	NTIS, PC A14/MF A01			
89-217707/XAB	15:614	NTIS, PC A13/MF A01			
89-217715/XAB	15:615	NTIS, PC A12/MF A01			
89-217723/XAB	15:1274	NTIS, PC A03/MF A01			
89-217749/XAB	15:1461	NTIS, PC A04/MF A01			
89-217913/XAB	15:1335	NTIS, PC A04/MF A01			
89-217921/XAB	15:1057	NTIS, PC A06/MF A01			
89-217988/XAB	15:719	NTIS, PC A04/MF A01			
89-218168/XAB	15:735	NTIS, PC A02/MF A01			
89-218184/XAB	15:1357	NTIS, PC A02/MF A01			
89-218259/XAB	15:1347	NTIS, PC A03/MF A01			
89-218267/XAB	15:736	NTIS, PC A03/MF A01			
89-218358/XAB	15:889	NTIS, PC A04/MF A01			
89-219232/XAB	15:86	NTIS, PC A04			
89-219240/XAB	15:100	NTIS, PC A12/MF A01			
89-219265/XAB	15:103	NTIS, PC A08/MF A01			
89-219968/XAB	15:720	NTIS, PC A05/MF A01			
89-220016/XAB	15:1336	NTIS, PC A04/MF A01			
89-220461/XAB	15:1337	NTIS, PC A17/MF A01			
89-220487/XAB	15:721	NTIS, PC A03/MF A01			
89-220511/XAB	15:1275	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-220602/XAB	15:1462	NTIS, PC A06/MF A01			
89-221311/XAB	15:25	NTIS, PC A03/MF A01			
89-221378/XAB	15:311	NTIS, PC A03/MF A01			
89-221394/XAB	15:737	NTIS, PC A03/MF A01			
89-222301/XAB	15:722	NTIS, PC A03/MF A01			
89-223291/XAB	15:738	NTIS, PC A05/MF A01			
89-224091/XAB	15:723	NTIS, PC A09/MF A01			
89-224760/XAB	15:724	NTIS, PC A04/MF A01			
89-225502/XAB	15:1358	NTIS, PC A04/MF A01			
89-225551/XAB	15:1359	NTIS, PC A03/MF A01			
89-225569/XAB	15:1360	NTIS, PC A03/MF A01			
89-228274/XAB	15:1064	NTIS, PC A14/MF A01			
89-229686/XAB	15:692	NTIS, PC A03/MF A01			
89-230015/XAB	15:890	NTIS, PC EE04/MF A01			
89-230650/XAB	15:101	NTIS, PC A03/MF A01			
89-230668/XAB	15:739	NTIS, PC A15/MF A01			
89-859995/XAB	15:1905	NTISPC N01/MF N01			
89-860514/XAB	15:1718	NTISPC N01/MF N01			
89-860696/XAB	15:1404	NTISPC N01/MF N01			
89-860803/XAB	15:1409	NTISPC N01/MF N01			
89-860837/XAB	15:12	NTISPC N01/MF N01			
89-860928/XAB	15:1412	NTISPC N01/MF N01			
89-861025/XAB	15:1276	NTISPC N01/MF N01			
89-862247/XAB	15:1348	NTISPC N01/MF N01			
89-864144/XAB	15:891	NTISPC N01/MF N01			
89-866255/XAB	15:744	NTISPC N01/MF N01			
89-868020/XAB	15:1463	NTISPC N01/MF N01			
89-868970/XAB	15:1065	NTISPC N01/MF N01			
89-868988/XAB	15:1066	NTISPC N01/MF N01			
89-869085/XAB	15:1993	NTISPC N01/MF N01			
89-869127/XAB	15:795	NTISPC N01/MF N01			
89-869143/XAB	15:79	NTISPC N01/MF N01			
89-869150/XAB	15:1338	NTISPC N01/MF N01			
89-869317/XAB	15:796	NTISPC N01/MF N01			
89-869325/XAB	15:797	NTISPC N01/MF N01			
89-869382/XAB	15:1277	NTISPC N01/MF N01			
89-869390/XAB	15:1278	NTISPC N01/MF N01			
89-869523/XAB	15:1994	NTISPC N01/MF N01			
89-869549/XAB	15:725	NTISPC N01/MF N01			
89-869622/XAB	15:726	NTISPC N01/MF N01			
89-869663/XAB	15:892	NTISPC N01/MF N01			
89-869796/XAB	15:995	NTISPC N01/MF N01			
89-869804/XAB	15:1339	NTISPC N01/MF N01			
89-869861/XAB	15:893	NTISPC N01/MF N01			
89-869887/XAB	15:64	NTISPC N01/MF N01			
89-869960/XAB	15:894	NTISPC N01/MF N01			
89-870109/XAB	15:123	NTISPC N01/MF N01			
89-870158/XAB	15:1340	NTISPC N01/MF N01			
89-916304/XAB	15:697	NTISSubscription			
89-920900/XAB	15:1465	NTISSubscription			
89-924700/XAB	15:619	NTISCP T99			
PFC/JA–					
89-37	15:1906	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001829	MF-421
89-43	15:1036	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001710	
PNL–					
6838	15:128	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001880	MF-820
6930	15:1303	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001499	MF-502; MF-507
6963	15:471	*See* EPRI-NP–6551			
6992	15:166	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001528	MF-502; MF-507
7126	15:254	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000984	MF-245
PNL-SA–					
16212	15:798	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002667	MF-423
16897	15:1341	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001897	MF-502
16955	15:167	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001901	MF-502
16957	15:654	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016820	MF-350
17002	15:168	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000814	MF-810
17065	15:357	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001392	MF-523
17354	15:500	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001389	MF-630

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PPPL–					
2654	15:1696	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001820	PC-426; PC-427
2656	15:1969	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001821	PC-420
2657	15:1885	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001822	PC-420
2658	15:1970	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001823	PC-420
PRRC–					
87-9	15:53	*See* PB–89-139323/XAB			
PW–					
5574-212-VOL-2	15:829	*See* N–89-18550			
RARDE–					
12/88	15:979	*See* AD-A–209108/0/XAB			
REG/G–					
90001148	15:501	NTIS, PC A03/MF A01; OSTI; INIS		TI90001148	
90001149	15:502	NTIS, PC A02/MF A01; OSTI; INIS		TI90001149	
REPT–					
89B00114	15:1056	*See* N–89-26184			
RFP–					
4352	15:169	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014175	MF-721
RIACS-TR–					
88.21	15:1055	*See* N–89-24578			
RISOE-R–					
567	15:626	*See* AD-A–210023/8/XAB			
RSI–					
0268	15:142	*See* DOE/CH/10378–4			
RUB–					
89-100	15:1542	*See* AD-A–209981/0/XAB			
SAND–					
86-0141	15:1222	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001867	MF-701
87-1246	15:170	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001884	MF-252
87-3139	15:355	*See* NUREG/CR–5079			
87-7141	15:298	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002088	MF-253
88-1377	15:1074	NTIS, PC A07/MF A01 - OSTI		DE90000897	MF-706
88-7018	15:496	*See* NUREG/CR–5098			
88-7111	15:339	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000525	PC-523
89-0497	15:1075	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001886	MF-506
89-0501	15:895	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001801	MF-504
89-0711C	15:1076	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000797	
89-0821	15:46	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001887	MF-126
89-1442C	15:1995	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012658	MF-700
89-1512C	15:1233	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000799	MF-706
89-1706C	15:216	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014245	MF-700
89-1720	15:1058	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000923	MF-906
89-1739C	15:340	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014132	
89-1900C	15:255	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000800	MF-706
89-1909C	15:473	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015794	MF-523
89-2034C	15:996	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000842	MF-700
89-2191C	15:1697	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000777	MF-700
89-2216C	15:997	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001623	MF-706
89-2222C	15:743	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000802	MF-700
89-2259C	15:1223	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000778	MF-706
89-2413C	15:799	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001501	MF-704
89-2440C	15:1996	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000787	MF-705
89-2441C	15:896	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001385	MF-704
89-2539C	15:1211	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001679	MF-704
89-2547C	15:503	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001624	MF-700
89-8250	15:33	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001787	MF-113
89-8251	15:1216	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001879	MF-700
SCC-R–					
104-F	15:1070	*See* AD-A–209944/8/XAB			
SEL–					
1216	15:1602	*See* PB–89-215461/XAB			
SERI/PR–					
215-3338	15:239	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009458	MF-234; MF-270
SERI/SP–					
220-3220	15:693	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009468	MF-350
SGD–					
438-PT-1	15:1598	*See* PB–89-158349/XAB			
492-PT-1	15:1596	*See* PB–89-158323/XAB			
492-PT-2	15:1597	*See* PB–89-158331/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
533-PT-1	15:1599	*See* PB–89-162481/XAB			
533-PT-2	15:1600	*See* PB–89-162499/XAB			
SPI–					
25-1	15:397	*See* N–89-17941			
25-1-VOL-3	15:399	*See* N–89-22980			
25-1-VOL-4	15:398	*See* N–89-18967			
SRC-TR–					
81-532	15:1457	*See* PB–89-216220/XAB			
81-536	15:1453	*See* PB–89-215842/XAB			
81-608	15:1452	*See* PB–89-215834/XAB			
81-614	15:1451	*See* PB–89-215826/XAB			
81-617	15:1448	*See* PB–89-215784/XAB			
81-635	15:1459	*See* PB–89-216618/XAB			
82-505	15:1460	*See* PB–89-216642/XAB			
82-520	15:1450	*See* PB–89-215818/XAB			
SU-CSSA-ASTRO–					
87-21	15:1575	*See* N–89-18375			
SU-SPO–					
4672	15:1576	*See* N–89-18376			
TR–					
17	15:751	*See* AD-A–209696/4/XAB			
177	15:1334	*See* PB–89-217566/XAB			
393	15:1394	*See* AD-A–210014/7/XAB			
84	15:992	*See* PB–89-177539/XAB			
TRI-PP–					
89-63	15:1097	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90001191	
TTC–					
0895	15:128	*See* PNL–6838			
U-OF-IOWA–					
89-11	15:1688	*See* N–89-26727			
UBA-FB–					
81-125	15:1085	Copy held by UB/TIB Hannover			
UCB-NE–					
4157	15:156	*See* LBL–27428			
UCID–					
21758	15:1230	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001881	MF-700
21791-1	15:1102	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001888	MF-700
21800	15:1059	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000957	MF-506
UCLA-ENG–					
8838	15:988	*See* N–89-20248			
UCRL–					
100272	15:998	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001517	MF-406
100498	15:1907	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002314	MF-705
100735	15:1997	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001680	MF-705
100792	15:837	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002220	MF-704
100833	15:800	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001509	
100904	15:1698	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001510	MF-700
101063	15:1971	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002234	MF-420
101115	15:1603	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002223	MF-700
101174	15:1791	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001516	MF-700
101299	15:1129	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001507	
101302	15:1881	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015776	MF-701
101305	15:217	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015706	MF-731
101399	15:999	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000190	MF-700
101437	15:1998	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000547	MF-506
101507	15:1437	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015626	MF-402
101542-Rev.1	15:1234	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001681	MF-742
101695	15:1977	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000818	MF-700
101706	15:1232	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001682	MF-706
101736	15:1280	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000819	MF-402
101842	15:504	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001511	MF-407
101859	15:107	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001504	MF-121
101903	15:1067	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000828	MF-700
101908	15:947	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001058	MF-700
101924	15:1604	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002221	MF-700
101947	15:1908	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002219	MF-420
101953	15:230	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001166	MF-700
101995	15:727	NTIS, PC A04/MF A01 - OSTI		DE90002107	MF-702
102033	15:171	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002225	MF-700
102100	15:1972	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002315	MF-712
21214-Vol.4	15:1279	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001103	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
UCRL–					
21226	15:1231	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001185	MF-702
52000-89-9	15:631	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001882	PC-700
98727	15:1544	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001143	MF-701
UKC/COMPUTING-LAB–					
58	15:1992	*See* PB–89-212435/XAB			
UR–					
1126	15:1764	*See* DOE/ER/13065–589			
USAFOEHL–					
81-09	15:1252	*See* AD-A–209791/3/XAB			
89-016EQ0146CEF	15:1251	*See* AD-A–209785/5/XAB			
89-020EQ0032CHH	15:730	*See* AD-A–209617/0/XAB			
USCG-D–					
18-88	15:68	*See* AD-A–204788/4/XAB			
USGS-OFR–					
89-359	15:172	NTIS, PC A03/MF A01 - GPO; OSTI; INIS; GPO Dep.	E 1.99:	DE90001382	
USGS/WRI–					
87-4211	15:1332	*See* PB–89-214894/XAB			
UTEC-MD–					
88-030	15:1100	*See* AD-A–204895/7/XAB			
UWAERP–					
20	15:1892	*See* DOE/ER/53242–3			
VLSI-M–					
88-491	15:1978	*See* AD-A–204210/9/XAB			
VTT-TUTK–					
582	15:16	NTIS (US Sales Only), PC A05/MF A01		DE89787767	
VTT/PUB–					
54	15:994	*See* PB–89-217095/XAB			
WES/TR/EL–					
88-15-2	15:1325	*See* AD-A–205136/5/XAB			
WHC-SA–					
0548	15:114	NTIS, PC A03/MF A01 - OSTI		DE90001241	MF-731
0603	15:115	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001128	MF-700
0606	15:1319	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000112	MF-700
0639	15:458	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001127	MF-705
0661	15:173	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001256	MF-721
0663	15:452	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89015579	MF-714
0718	15:174	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001254	MF-610
0730	15:478	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001237	MF-500
0753	15:505	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001138	MF-707
WHC-SP–					
0193	15:1304	NTIS, PC A12/MF A01 - OSTI		DE90001260	MF-502
WHOI–					
86-19	15:1330	*See* PB–89-203616/XAB			
WINCO–					
1068	15:175	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001871	PC-510
1069	15:1320	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001861	PC-510
WORLD-BANK-TP–					
96	15:67	*See* PB–89-196885/XAB			
WSRC-RP–					
89-25	15:506	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001374	MF-706
89-376	15:507	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017847	MF-707
89-385	15:480	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017871	MF-706
89-386	15:897	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014146	MF-714
89-388	15:1286	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017843	MF-702
89-511	15:176	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001313	MF-704
89-518	15:1000	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001317	MF-701
89-659-Rev.1	15:177	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001311	MF-705; MF-721
89-740	15:178	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001309	MF-721
89-77	15:967	NTIS, PC A03/MF A01 - OSTI		DE90001379	MF-702
89-822	15:1305	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001284	MF-702; MF-721
Y/DX–					
878	15:1001	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002066	MF-706
YJT–					
88-13	15:179	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606380	
ZfK–					
584	15:1777	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90705936	

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

Order No.	*Report No.*
DE88780080	GSCAN-P–85-1B
DE88780081	INIS-mf–11153
DE88780094	INIS-SU–10
DE89000770	DOE/BC/10845–15
DE89000772	DOE/BC/10847–15
DE89000774	DOE/MC/22042–15
DE89000997	DOE/FC/10628–2712-Vol.1
DE89006038	CONF-881155–44
DE89009458	SERI/PR–215-3338
DE89009468	SERI/SP–220-3220
DE89011685	DOE/LC/11066–2719-Vol.2
DE89011686	DOE/LC/11066–2719-Vol.3
DE89012331	CONF-891116–1
DE89012390	CONF-891103–2
DE89012658	SAND–89-1442C
DE89013279	CONF-891140–2
DE89013579	CONF-891140–1
DE89014075	CONF-891103–11
DE89014132	SAND–89-1739C
DE89014146	WSRC-RP–89-386
DE89014175	RFP–4352
DE89014225	LA-UR–89-2124
DE89014245	SAND–89-1706C
DE89014270	LA-UR–89-2209
DE89014271	LA-UR–89-2207
DE89014311	LA-UR–89-2046
DE89014313	LA-UR–89-2032
DE89014317	LA-UR–89-2017
DE89014469	LA-UR–89-2210
DE89014779	CONF-891119–1
DE89014851	GA-A–19701
DE89015074	BNL–42892
DE89015256	LA-UR–89-2418
DE89015539	HW–26471
DE89015579	WHC-SA–0663
DE89015626	UCRL–101507
DE89015706	UCRL–101305
DE89015776	UCRL–101302
DE89015794	SAND–89-1909C
DE89015871	CONF-891103–19
DE89015873	CONF-891103–21
DE89015893	CONF-891103–20
DE89015894	CONF-891118–3
DE89015903	CONF-891103–18
DE89016039	CONF-8909188–1
DE89016164	CONF-891118–4
DE89016193	EGG-BNCT–8353-Vol.3-No.6
DE89016195	EGG-M–89187
DE89016205	EGG-M–89256
DE89016231	CONF-891103–24
DE89016267	CONF-891103–25
DE89016290	CONF-891103–26
DE89016607	LA-UR–89-2607
DE89016610	LA-UR–89-2913
DE89016786	DOE/SF/17128–T1
DE89016803	CONF-881097–1
DE89016820	PNL-SA–16957
DE89017726	LBL–8688-Rev.5
DE89017727	LBL–8678-Rev.3
DE89017728	LBL–8706-Suppl.-Rev.5
DE89017760	CONF-8909163–Absts.
DE89017764	CONF-891118–8
DE89017808	DOE/ER/13834–8
DE89017843	WSRC-RP–89-388
DE89017847	WSRC-RP–89-376
DE89017871	WSRC-RP–89-385
DE89017908	CONF-8811259–1
DE89782366	GRSJ–8901
DE89782628	NEDOJ–P-8715
DE89787767	VTT-TUTK–582
DE89793120	ETDE-IT–89-03
DE89900544	JSES–8801
DE89900733	IRIM–8801
DE89900735	NAL-TR–987
DE89900737	NAL-TR–960
DE89901255	CRIE-U–88020
DE89901256	CRIE-T–87097
DE89901257	CRIE-T–87093
DE89901258	CRIE-T–87081
DE89901259	CRIE-T–88004
DE89901260	CRIE-T–87095
DE89901261	CRIE-T–87089
DE89901262	CRIE-T–87084
DE89901263	CRIE-T–87094
DE89901264	CRIE-T–87100
DE89901265	CRIE-T–87086
DE89901267	CRIE-T–87077
DE89901268	CRIE-T–87092
DE89901269	CRIE-T–87099
DE89901270	CRIE-T–87116
DE89901271	CRIE-U–05
DE89901292	CRIE-U–87098
DE89901293	CRIE-U–88023
DE89901294	CRIE-U–88037
DE89901295	CRIE-U–88018
DE89901296	CRIE-U–88041
DE89901297	CRIE-U–88036
DE89901303	CRIE-T–87110
DE90000108	BNL-NCS–43194
DE90000112	WHC-SA–0606
DE90000116	JINR-E–4-89-11
DE90000161	JINR-E–4-89-55
DE90000167	LBL–27249
DE90000190	UCRL–101399
DE90000198	LA-UR–89-3210
DE90000523	JINR-E–4-88-917
DE90000525	SAND–88-7111
DE90000530	BNL–42593
DE90000536	LA-UR–89-3000
DE90000537	LA-UR–89-3008
DE90000540	LA-UR–89-3002
DE90000541	LA-UR–89-3001
DE90000547	UCRL–101437
DE90000551	LBL–27617
DE90000573	CONF-8804141–9
DE90000574	CONF-8911100–1
DE90000632	DOE/SF/16667–T1
DE90000642	DOE/PC/71257–T18
DE90000678	LA-UR–89-3301
DE90000680	LA-UR–89-3265
DE90000687	LA-UR–89-3232
DE90000695	LA-UR–89-3171
DE90000714	JINR-E–10-89-362
DE90000715	JINR-E–9-89-324
DE90000718	JINR-E–6-89-413
DE90000724	CONF-8810116–Summ.
DE90000730	DOE/ER/40231–T6
DE90000731	DOE/ER/40231–T7
DE90000777	SAND–89-2191C
DE90000778	SAND–89-2259C
DE90000787	SAND–89-2440C
DE90000797	SAND–89-0711C
DE90000799	SAND–89-1512C
DE90000800	SAND–89-1900C
DE90000802	SAND–89-2222C
DE90000814	PNL-SA–17002
DE90000818	UCRL–101695
DE90000819	UCRL–101736
DE90000828	UCRL–101903
DE90000842	SAND–89-2034C
DE90000872	CONF-8906112–
DE90000897	SAND–88-1377
DE90000923	SAND–89-1720
DE90000955	DOE/NE–0097
DE90000957	UCID–21800
DE90000959	CONF-8804141–
DE90000961	ORNL–6526/R7
DE90000962	ORNL–6526/R8
DE90000963	ORNL–6565
DE90000964	ORNL–6569
DE90000965	ORNL–6570
DE90000966	ORNL–6573
DE90000971	ORNL/CDIAC–27
DE90000973	ORNL/Sub–85-22012/1
DE90000980	ORNL/Sub–87-SB064/1
DE90000982	ORNL/TM–11294
DE90000984	PNL–7126
DE90000985	DOE/ID/12356–1
DE90000992	ORNL/TM–11309
DE90000995	DOE/EH–0103-Vol.1
DE90000996	DOE/EH–0103-Vol.2
DE90001036	DOE/ID/12553–3
DE90001058	UCRL–101908
DE90001066	CONF-8810432–1
DE90001103	UCRL–21214-Vol.4
DE90001105	DOE/MC/23288–2742
DE90001110	DOE/EA–0408
DE90001114	CONF-880551–Summs.
DE90001126	DOE/RL–89-13
DE90001127	WHC-SA–0639
DE90001128	WHC-SA–0603
DE90001138	WHC-SA–0753
DE90001140	LBL–27638
DE90001141	LBL–27668
DE90001143	UCRL–98727
DE90001166	UCRL–101953
DE90001177	DOE/ER/40402–2
DE90001185	UCRL–21226
DE90001191	TRI-PP–89-63
DE90001235	LA-UR–89-3135
DE90001236	LA-UR–89-3310
DE90001237	WHC-SA–0730
DE90001241	WHC-SA–0548

Order No.	Report No.
DE90001245	ORNL/FTR–3400
DE90001254	WHC-SA–0718
DE90001256	WHC-SA–0661
DE90001260	WHC-SP–0193
DE90001269	BNL–43250
DE90001271	BNL–43296
DE90001277	ORNL/Sub–86-57444/01
DE90001280	ORNL/RASA–88/51
DE90001282	ORNL/FTR–3097
DE90001283	ORNL/FTR–3090
DE90001284	WSRC-RP–89-822
DE90001285	ORNL/FTR–3096
DE90001287	ORNL/M–966
DE90001288	DOE/FTR–90001288
DE90001289	DOE/FTR–90001289
DE90001290	DOE/FTR–90001290
DE90001291	DOE/FTR–90001291
DE90001293	DOE/FTR–90001293
DE90001294	ORNL/FTR–3411
DE90001296	ORNL/FTR–3422
DE90001299	ORNL/FTR–3031
DE90001301	ORNL/FTR–3067
DE90001302	ORNL/FTR–3068
DE90001309	WSRC-RP–89-740
DE90001311	WSRC-RP–89-659-Rev.1
DE90001313	WSRC-RP–89-511
DE90001317	WSRC-RP–89-518
DE90001318	DPST–89-348
DE90001319	DOE/FTR–90001319
DE90001320	DOE/FTR–90001320
DE90001321	DOE/FTR–90001321
DE90001322	DOE/FTR–90001322
DE90001330	BNL–42852
DE90001334	CONF-8910225–5
DE90001337	CONF-891057–2
DE90001345	CONF-891027–4
DE90001346	CONF-8909238–1
DE90001349	CONF-8910162–4
DE90001354	CONF-8910225–2
DE90001359	CONF-8910235–1
DE90001360	ORNL/TM–11318
DE90001361	CONF-891027–3
DE90001374	WSRC-RP–89-25
DE90001379	WSRC-RP–89-77
DE90001382	USGS-OFR–89-359
DE90001385	SAND–89-2441C
DE90001388	LA–11550-MS
DE90001389	PNL-SA–17354
DE90001392	PNL-SA–17065
DE90001396	ORNL/FTR–3403
DE90001403	DOE/ER/13065–589
DE90001408	CONF-8905231–1
DE90001411	CONF-890814–8
DE90001412	CONF-8908164–1
DE90001416	CONF-8910246–1
DE90001417	ANL-HEP-CP–89-104
DE90001420	LBL–26499
DE90001424	LBL–26321
DE90001426	DOE/ER/25009–831
DE90001427	LA–11633-MS
DE90001429	CONF-8909231–1
DE90001431	CONF-8909232–1
DE90001432	CONF-8909128–4
DE90001437	CONF-890982–4
DE90001438	ANL-HEP-CP–89-102
DE90001439	CONF-8909235–2
DE90001440	CONF-8909141–2
DE90001443	CONF-8909234–1
DE90001451	CONF-8907140–2
DE90001452	DOE/ER/60636–T3
DE90001453	DOE/ER/60636–T1
DE90001468	DOE/PC/88653–T1
DE90001481	DOE/ER/53266–16
DE90001482	CONF-8910241–1
DE90001483	ORNL/tr–89/43
DE90001484	ORNL/tr–89/44
DE90001485	ORNL/tr–89/45
DE90001486	ORNL/RASA–87/33
DE90001488	DOE/ER/60409–4
DE90001493	ORNL/FTR–3402
DE90001494	ORNL/FTR–3418
DE90001496	ORNL/FTR–3397
DE90001497	ORNL/FTR–3379
DE90001498	K/ITP–192
DE90001499	PNL–6930
DE90001501	SAND–89-2413C
DE90001504	UCRL–101859
DE90001507	UCRL–101299
DE90001509	UCRL–100833
DE90001510	UCRL–100904
DE90001511	UCRL–101842
DE90001516	UCRL–101174
DE90001517	UCRL–100272
DE90001522	DOE/ER/60539–T2
DE90001524	DOE/ER/60524–2
DE90001528	PNL–6992
DE90001538	ORNL/FTR–3416
DE90001539	ORNL/FTR–3398
DE90001540	LBL–27728
DE90001542	LBL–27004
DE90001545	ORNL/FTR–3405
DE90001548	BNL–43335
DE90001560	ORNL/RASA–87/32
DE90001566	CONF-8905224–1
DE90001567	DOE/ER/13881–2
DE90001568	LBL–27563
DE90001577	DOE/ER/13574–1
DE90001581	ORNL/tr–89-47
DE90001589	ORNL/RASA–88/25
DE90001590	ORNL/FTR–3406
DE90001600	DOE/ID/12422–2
DE90001608	CONF-8910237–2
DE90001609	CONF-880913–9
DE90001610	CONF-8905235–1
DE90001623	SAND–89-2216C
DE90001624	SAND–89-2547C
DE90001635	CONF-8909243–1
DE90001641	CONF-891020–1
DE90001644	CONF-8908108–3
DE90001657	DOE/SSDP–0053
DE90001658	DOE/SSDP–0082
DE90001660	BNWL-CC–2378
DE90001661	BNWL-CC–2188
DE90001679	SAND–89-2539C
DE90001680	UCRL–100735
DE90001681	UCRL–101542-Rev.1
DE90001682	UCRL–101706
DE90001696	DOE/FTR–90001696
DE90001697	DOE/FTR–90001697
DE90001698	DOE/FTR–90001698
DE90001699	DOE/EIA–M036
DE90001702	DOE/FTR–90001702
DE90001703	DOE/MC/24207–2748
DE90001704	DOE/ER/53242–3
DE90001705	DOE/FTR–90001705
DE90001706	DOE/FTR–90001706
DE90001708	DOE/ER/45231–4
DE90001710	PFC/JA–89-43
DE90001712	ORNL/FTR–3421
DE90001713	DPT–132
DE90001718	DPT–128
DE90001719	DOE/ER/13427–2
DE90001721	DOE/ER/53264–2
DE90001723	DOE/RL/11396–T1
DE90001724	DOE/FTR–90001724
DE90001725	DOE/FTR–90001725
DE90001726	DOE/FTR–90001726
DE90001727	CONF-890828–2
DE90001737	CONF-891007–24
DE90001739	CONF-891091–2
DE90001741	ORNL/FTR–2908
DE90001742	ORNL/FTR–2918
DE90001743	ORNL/FTR–2920
DE90001744	ORNL/FTR–2933
DE90001745	ORNL/FTR–2950
DE90001746	ORNL/FTR–2941
DE90001747	ORNL/FTR–2954
DE90001748	ORNL/FTR–2972
DE90001751	NISTIR–89-4167
DE90001752	DOE/BC/14403–2
DE90001754	DOE/ER/45190–2
DE90001757	CONF-8910225–3
DE90001758	CONF-891120–3
DE90001762	CONF-890971–3
DE90001765	CONF-8909219–2
DE90001766	CONF-890902–17
DE90001767	CONF-8909170–2
DE90001773	CONF-890820–5
DE90001777	BNL–52215
DE90001778	LA–11672-PR
DE90001787	SAND–89-8250
DE90001801	SAND–89-0501
DE90001810	LA–11677-MS
DE90001820	PPPL–2654
DE90001821	PPPL–2656
DE90001822	PPPL–2657
DE90001823	PPPL–2658
DE90001827	LA-UR–89-3124
DE90001829	PFC/JA–89-37
DE90001830	LA-UR–89-3116
DE90001831	LA-UR–89-3111
DE90001845	ORNL/Sub–88-SC924/1
DE90001846	ORNL/Sub–86-SA094/3
DE90001849	ORNL/TM–11194
DE90001850	ORNL/CON–289
DE90001854	ORNL/TM–11286
DE90001857	ORNL/TM–11214
DE90001859	ORNL/TM–11311
DE90001861	WINCO–1069
DE90001867	SAND–86-0141
DE90001871	WINCO–1068
DE90001872	FNAL-TM–1616
DE90001873	FNAL-TM–1617
DE90001876	FNAL-TM–1619
DE90001877	FNAL-TM–1618
DE90001879	SAND–89-8251
DE90001880	PNL–6838
DE90001881	UCID–21758
DE90001882	UCRL–52000-89-9
DE90001884	SAND–87-1246
DE90001886	SAND–89-0497
DE90001887	SAND–89-0821
DE90001888	UCID–21791-1
DE90001890	DOE/EIS–0146
DE90001891	LA–11510-MS-Pt.2
DE90001897	PNL-SA–16897
DE90001901	PNL-SA–16955
DE90001907	CONF-891130–1
DE90001908	CONF-891119–2
DE90001913	CONF-891001–8
DE90001915	DOE/OR/21389–22
DE90001916	DOE/EIA–0523(89/2Q)
DE90001917	DOE/EIA–0520(89/10)
DE90001921	CONF-891149–8
DE90001923	CONF-891103–35
DE90001925	CONF-891103–36

Order No.	Report No.
DE90001929	CONF-891046–2
DE90001930	CONF-891117–5
DE90001932	DOE/OR/21864–2
DE90001933	DOE/OR/21389–23
DE90001934	DOE/MC/23270–2751
DE90001935	DOE/SR/15199–2
DE90001939	CONF-891046–3
DE90001941	CONF-891013–4
DE90001958	CONF-891013–5
DE90001959	CONF-8910225–4
DE90001960	CONF-891087–6
DE90001964	CONF-891113–4
DE90001968	CONF-890971–5
DE90001980	DOE/ER/45384–1
DE90001981	CONF-890953–8
DE90001983	CONF-890902–18
DE90001984	CONF-890902–19
DE90001985	CONF-8909218–1
DE90001987	ANL-HEP-CP–89-55
DE90001988	CONF-890971–4
DE90001996	DOE/DP/10560–6
DE90001997	EGG-M–88267
DE90002002	EGG-M–00688
DE90002008	DOE/ID–10237
DE90002014	EGG-M–88242
DE90002019	EGG-M–89239
DE90002022	EGG-BEG–8665
DE90002024	EGG-M–89303
DE90002026	EGG-FSP–8678
DE90002033	EGG-M–88435
DE90002035	EGG-M–89237
DE90002036	EGG-M–89206
DE90002037	DOE/ER/60674–2
DE90002039	DOE/ID/12584–44
DE90002040	EGG-M–89208
DE90002041	EGG-M–89204
DE90002043	EGG-M–89279
DE90002048	EGG-M–89235
DE90002051	EGG-M–89213
DE90002052	EGG-M–89214
DE90002054	EGG-M–88320
DE90002056	EGG-M–89216
DE90002057	EGG-M–89063
DE90002066	Y/DX–878
DE90002069	EGG-MS–8696
DE90002071	EGG-M–89202
DE90002072	EGG-M–89181
DE90002077	EGG-BNCT–8353-Vol.3-No.5
DE90002079	EGG-M–89099
DE90002080	EGG-EP–8656
DE90002083	LBL–27378
DE90002088	SAND–87-7141
DE90002093	EGG-M–88287
DE90002096	DOE/RL–88-27-Add.1
DE90002098	DOE/EIS–0134-F
DE90002099	DOE/RL–88-27-Suppl.1
DE90002107	UCRL–101995
DE90002114	DOE/ER/53212–144
DE90002116	DOE/RL/11396–1
DE90002117	DOE/ER/60686–1
DE90002122	LBL–27661
DE90002125	ORNL/FTR–3010
DE90002128	ORNL/Sub–85-27488/04
DE90002129	ORNL/RASA–88/56
DE90002130	ORNL/RASA–87/35
DE90002131	ORNL/RASA–88/55
DE90002133	ORNL/RASA–88/58
DE90002134	ORNL/RASA–88/39
DE90002138	ORNL/FTR–3066
DE90002140	ORNL/FTR–3176
DE90002141	ORNL/FTR–3180
DE90002143	ORNL/FTR–3186
DE90002144	ORNL/FTR–3156
DE90002145	ORNL/FTR–3245
DE90002147	EGG-M–88389
DE90002148	EGG-FSP–8709
DE90002149	EGG-BNCT–8353-Vol.3-No.7
DE90002151	ORNL/M–785
DE90002152	CONF-891007–22
DE90002164	DOE/SR/18049–1
DE90002173	CONF-8908145–3
DE90002180	CONF-890875–2
DE90002181	CONF-890855–59
DE90002182	CONF-8907114–3
DE90002183	CONF-890771–5
DE90002185	CONF-890798–13
DE90002189	CONF-890703–20
DE90002196	CONF-890526–2
DE90002197	CONF-8905190–1
DE90002201	CONF-890563–3
DE90002207	ANL-HEP-CP–89-107
DE90002212	ANL-HEP-CP–89-87
DE90002214	CONF-8906112–3
DE90002216	CONF-890692–23
DE90002219	UCRL–101947
DE90002220	UCRL–100792
DE90002221	UCRL–101924
DE90002223	UCRL–101115
DE90002225	UCRL–102033
DE90002227	CONF-890335–261
DE90002228	CONF-890335–262
DE90002229	EGG-ESE–8600
DE90002232	EGG-ER–8623
DE90002234	UCRL–101063
DE90002239	DOE/ER–0392
DE90002240	CONF-890335–268
DE90002241	CONF-890335–269
DE90002242	CONF-890335–263
DE90002243	CONF-890335–260
DE90002247	DOE/PC/90533–9
DE90002248	CONF-890335–265
DE90002250	ANL-HEP-CP–89-53
DE90002252	CONF-890335–266
DE90002253	CONF-890335–270
DE90002254	CONF-890488–13
DE90002257	CONF-890488–12
DE90002264	CONF-890480–3
DE90002265	CONF-890468–14
DE90002267	ANL-HEP-CP–89-52
DE90002269	CONF-890468–13
DE90002271	CONF-8904232–2
DE90002275	CONF-891119–3
DE90002277	ANL-HEP-CP–89-60
DE90002283	ORNL/tr–89/41
DE90002290	BNL–43346
DE90002291	BNL–43374
DE90002311	BNL–43322
DE90002314	UCRL–100498
DE90002315	UCRL–102100
DE90002327	LA–11701-MS
DE90002329	LBL–27663
DE90002330	LBL–27428
DE90002331	LBL–27377
DE90002333	LBL–27821
DE90002346	LA-UR–89-3281
DE90002347	LA-UR–89-3280
DE90002348	LA-UR–89-3279
DE90002349	DOE/CH/10378–4
DE90002351	LA-UR–89-3276
DE90002353	LA-UR–89-3271
DE90002355	LA-UR–89-3262
DE90002356	LA-UR–89-3261
DE90002357	LA-UR–89-3233
DE90002358	LA-UR–89-3043
DE90002383	LA-UR–89-3426
DE90002391	LA-UR–89-3383
DE90002392	LA-UR–89-3382
DE90002399	LA-UR–89-3534
DE90002403	LA-UR–89-3499
DE90002405	LA-UR–89-3486
DE90002406	LA-UR–89-3482
DE90002410	LA-UR–89-3596
DE90002413	LA-UR–89-3576
DE90002415	LA-UR–89-3560
DE90002419	LA-UR–89-3609
DE90002426	DOE/FTR–90002426
DE90002434	LA-UR–89-3353
DE90002435	LA-UR–89-3352
DE90002438	LA-UR–89-3336
DE90002441	LA-UR–89-3327
DE90002442	LA-UR–89-3322
DE90002443	LA-UR–89-3299
DE90002444	LA-UR–89-3298
DE90002446	LA-UR–89-3293
DE90002448	LA-UR–89-3291
DE90002457	BNL–43198
DE90002459	LBL–26612-Vol.3
DE90002471	CONF-891007–73
DE90002475	CONF-891117–9
DE90002476	CONF-891055–1
DE90002510	LA–11659-M
DE90002547	DOE/ER/13454–T4
DE90002588	BNL–43057
DE90002593	DOE/EIA–0202(89)
DE90002594	DOE/EIA–0035(89/07)
DE90002646	DOE/EIA–0131(88)/1
DE90002647	DOE/EIA–0131(88)/2
DE90002667	PNL-SA–16212
DE90002685	LBL–27691
DE90606044	INIS-BR–1624
DE90606120	INIS-BR–1637
DE90606121	INIS-BR–1611
DE90606124	INIS-BR–1628
DE90606125	INIS-BR–1629
DE90606126	INIS-BR–1630
DE90606127	INIS-BR–1633
DE90606134	INIS-BR–1655
DE90606135	INIS-BR–1658
DE90606136	INIS-BR–1671
DE90606137	INIS-BR–1677
DE90606140	IPEN-PUB–258
DE90606173	INIS-BR–1634
DE90606175	INIS-BR–1657
DE90606186	INIS-BR–1653
DE90606187	INIS-BR–1668
DE90606194	INIS-BR–1660
DE90606221	INIS-BR–1645
DE90606321	INIS-BR–1659
DE90606331	CEGB-TPRD/L–3261/R88
DE90606380	YJT–88-13
DE90606536	IPEN-PUB–255
DE90606537	INIS-BR–1631
DE90606538	INIS-BR–1632
DE90606777	INIS-BR–1673
DE90606778	INIS-BR–1674
DE90606779	INIS-BR–1675
DE90705934	INIS-mf–11544
DE90705935	INIS-SU–128
DE90705936	ZfK–584
DE90711185	IABG-TF–1950
DE90713662	FRNC-TH–3509
DE90713663	FRNC-TH–3507
DE90713664	FRNC-TH–3500
DE90713720	EEO-ED–142/31
DE90713721	EEO-ED–32/1
DE90713722	EEO-ED–251/291

Order No.	Report No.
DE90713723	EEO-ED–245/208
DE90713724	EEO-ED–240/270
DE90713725	EEO-ED–238/229
DE90713726	EEO-ED–205/188
DE90713727	EEO-ED–189/199
DE90713728	EEO-ED–229/317
DE90713729	EEO-ED–206/228
DE90713730	EEO-ED–237/174
DE90713731	EEO-ED–236/242
DE90713732	EEO-ED–223/241
DE90713733	EEO-ED–75
DE90713734	EEO-ED–40/98
DE90713735	EEO-ED–190/216
DE90713736	EEO-ED–181/167
DE90713737	EEO-ED–239/210
DE90713738	EEO-ED–147/204
DE90713739	EEO-ED–144/140
DE90713764	LAPP-EXP–88-18
DE90713769	ISN–88-103
DE90713771	ISN–89-12
DE90713776	CRN-PN–89-03
DE90713780	LAPP-EXP–88-09
DE90713781	LAPP-EXP–88-11
DE90713788	CENBG–88-23
DE90713791	ISN–89-09
DE90713878	CEA-CONF–9775
DE90717857	INIS-mf–12009
DE90717898	INIS-mf–12014
DE90717899	INIS-mf–12022
DE90717901	INIS-mf–12010
DE90717903	IKF-IB–72
DE90717904	BfG–0447
DE90717905	GSF–15/88
DE90717906	NUKEM-FuE–88019
DE90717907	INIS-mf–12008
DE90718097	KFK–4602
DE90718098	KFK–4593
DE90718101	KFK–4601
DE90718150	Juel–2294
DE90718173	Juel-Conf–67
DE90718174	Juel-Spez–496
DE90718176	KWU-R–917/87/001
DE90718225	KFK–4581
DE90718231	MPI-PAE/Exp.El.–211
DE90718232	GSI–89-68(prepr.)
DE90718233	GSI–89-67(prepr.)
DE90718234	BONN-IR–89-26
DE90718235	GSI–89-24
DE90718236	GSI–89-21
DE90718237	BONN-IR–89-20
DE90718238	BONN-IR–89-22
DE90718239	MPI-PAE/Exp.El.–208
DE90718251	INIS-mf–12021
TI90000073	CAPE–3016
TI90000092	NUREG/BR–0121
TI90000746	NUREG/CP–0104
TI90001148	REG/G–90001148
TI90001149	REG/G–90001149
TI90001304	EPA–520/5-89-008
TI90001305	NUREG–1385
TI90001362	NUREG/CP–0102-Vol.2
TI90001370	NUREG/CR–1754-Add.1
TI90001371	NUREG/CR–5098
TI90001479	NUREG/CR–5365
TI90001582	NUREG/CR–5429-Vol.1
TI90001583	NUREG/CR–4735-Vol.5
TI90001584	NUREG/CR–5429-Vol.3
TI90001586	NUREG/CR–5395-Vol.3
TI90001685	NUREG/CR–5395-Vol.5
TI90002109	NUREG/CR–5079

Codes Used on Index Lines

Following the citation numbers in the Corporate Author, Personal Author, and Subject Indexes, codes are used to designate the type of document, country of publication, and language of the document, e.g., (R;SU;In Russian). The language designator does not appear if the document is published in English.

Document Types

J Journal article
TJ Translation of a journal article
R Report
RA Report analytic
B Book
BA Book analytic
P Patent
E Engineering materials
D Dissertation
TG Translation (general)
TA Translation (analytic)

Country Codes

AD Andorra
AE United Arab Emirates
AF Afghanistan
AL Albania
AR Argentina
AT Austria
AU Australia

BB Barbados
BD Bangladesh
BE Belgium
BG Bulgaria
BH Bahrain
BI Burundi
BJ Benin
BM Bermuda
BO Bolivia
BR Brazil
BS Bahamas
BT Bhutan
BU Burma
BW Botswana
BY Byelorussian Soviet Socialist Republic (Byelorussian SSR)

CA Canada
CB Khmer Republic
CF Central African Republic
CG Congo
CH Switzerland
CI Ivory Coast
CL Chile
CM United Republic of Cameroon
CN China
CO Colombia
CR Costa Rica
CS Czechoslovakia
CU Cuba
CY Cyprus

DD German Democratic Republic
DE Germany, Fed. Republic of (F.R. Germany)
DK Denmark
DO Dominican Republic
DZ Algeria

EC Ecuador
EG Egypt
ES Spain
ET Ethiopia

FI Finland
FJ Fiji
FR France

GA Gabon
GB United Kingdom of Great Britain and Northern Ireland (UK)
GD Grenada
GH Ghana
GM Gambia
GN Guinea
GQ Equatorial Guinea
GR Greece
GT Guatemala
GU Guam
GW Guinea-Bissau
GY Guyana

HK Hong Kong
HN Honduras
HT Haiti
HU Hungary
HV Upper Volta

ID Indonesia
IE Ireland
IL Israel
IN India
IQ Iraq
IR Iran
IS Iceland
IT Italy

JM Jamaica
JO Jordan
JP Japan
KE Kenya
KH Democratic Kampuchea
KP Democratic People's Republic of Korea
KR Korea, Republic of
KW Kuwait

LA Laos
LB Lebanon
LI Liechtenstein
LK Sri Lanka
LR Liberia
LS Lesotho
LU Luxembourg
LY Libyan Arab Republic

MA Morocco
MC Monaco
MG Madagascar
ML Mali
MN Mongolia
MR Mauritania
MT Malta
MU Mauritius
MV Maldives
MW Malawi
MX Mexico
MY Malaysia

NE Niger
NG Nigeria
NI Nicaragua
NL Netherlands
NO Norway
NP Nepal
NR Nauru
NZ New Zealand

OM Oman

PA Panama
PE Peru
PG Papua New Guinea
PH Philippines
PK Pakistan
PL Poland
PR Puerto Rico
PT Portugal
PY Paraguay

QA Qatar

RH Southern Rhodesia
RO Romania
RW Rwanda
SA Saudi Arabia
SD Sudan
SE Sweden
SG Singapore
SK Sikkim
SL Sierra Leone
SM San Marino
SN Senegal
SO Somalia
SU Union of Soviet Socialist Republics (USSR)
SV El Salvador
SY Syria
SZ Swaziland

TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VE Venezuela
VI Virgin Islands of the United States
VN Viet Nam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

ORDER FORM

DOE and DOE contractors: Fill in Parts I, II, and IV. **Others:** Fill in Parts I, III, and IV. Mark appropriate blanks in Part IV to indicate quantity and form (microfiche or paper copy).

I. SHIPPING AND PAYMENT INFORMATION

Ordering Address

Name _____ Telephone _____

Address _____

City _____ State _____ ZIP _____

Shipping Address (if different from above)

Name _____

Address _____

City _____ State _____ ZIP _____

_____

SIGNATURE (Required to validate ALL orders)

II. OSTI ORDERS (DOE and DOE contractors can order from OSTI.)

☐ Charge OSTI deposit account no. _____

Mail orders to: U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

III. NTIS ORDERS

☐ Charge NTIS deposit account no. _____

☐ Check/Money Order enclosed for $ _____

☐ Charge to my ☐ American Express ☐ VISA ☐ MasterCard

_____ _____
Account Number Card expiration date

☐ Ship & Bill (see below for restrictions)
Employer identification number (9 digits) __ __ - __ __ __ __ __ __ __

Purchase Order number _____

Phone number of billing office _____
(Required for Ship & Bill orders)

Ship & Bill service is restricted to North American business locations for an extra $7.50 per order (or per Custom Search). The business' employer identification number plus the phone number of the office paying the bill are required to process these requests. A late payment charge will be applied to billings more than 30 days overdue. Prepaying, using an NTIS Deposit Account or a charge account, speeds order processing. Be sure payment and order are sent together. Checks, payable to NTIS, must be in U.S. dollars.

Mail orders to: U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

IF NO METHOD OF PAYMENT IS INDICATED, YOUR ORDER WILL BE RETURNED TO YOU AS A PRICE QUOTE UNPROCESSED.

IV. SELECTIONS

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

CUT OUT APPROPRIATE FORM AND MAIL IN A STAMPED ENVELOPE TO THE ADDRESS INDICATED.

Change of Address Form

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

MAIL THIS FORM TO:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

Subscription Order Form

Enter my Subscription to: _____

(Please indicate publication)

@ $_____ Domestic; @ $_____ Foreign.

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No._____

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Direct access to the world's most comprehensive energy data base

OnLine

The Energy Data Base (EDB), produced by the Department of Energy, Office of Scientific and Technical Information (OSTI), is a computer-readable bibliographic data base containing citations, abstracts, and indexes to all types of domestic and foreign scientific and technical literature on energy, including energy sources, conservation, energy policy, advanced energy systems, environmental aspects of energy, and basic scientific studies in physics, chemistry, biology, and engineering. The EDB contains over 1,500,000 references from worldwide sources. It is updated bimonthly.

The complete data base is leased to two commercial on-line systems and is available on magnetic tape through the National Technical Information Service.

One year of EDB files is available to DOE and its contractors through the OSTI Automated Retrieval System (OARS). The OSTI Integrated Technical Information System (ITIS), which is a communication link to the on-line systems of OSTI and to commercial and other government on-line systems, provides a gateway through which EDB can be accessed by DOE and its contractors on the commercial systems also. Inquiries concerning access by this means should be addressed to:

U.S. Department of Energy
Office of Scientific and
Technical Information
P.O. Box 62
Oak Ridge, Tennessee 37831

EDB ON COMMERCIAL SYSTEMS

- *DIALOG Information Services, Inc.*
  3460 Hillview Avenue
  Palo Alto, California 94304
  Phone: (800) 334-2564

- *STN International*
  Chemical Abstracts Service
  2540 Olentangy River Road
  P.O. Box 3012
  Columbus, Ohio 43210
  Phone: (800) 848-6533
  Phone: (614) 421-3600

Federal Depository Library Program

As a result of an agreement between the U.S. Government Printing Office (GPO) and the Department of Energy, beginning in 1984 DOE reports with unlimited distribution are now included in the Federal Depository Library Program. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and interlibrary loans; however, they are not sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself. Do not send checks or orders to these libraries.

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor-State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Government Documents Dept.
Tucson, AZ 85721
(602) 626-5233

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

UNIV. OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

UNIVERSITY OF KANSAS
Doc. Collect.-Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

UNIVERSITY OF MARYLAND
McKeldin Lib.-Doc. Div.
College Park, MD 20742
(301) 454-3034

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
(in cooperation with University of Nebraska-Lincoln)

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

Order Number Correlation	Report Number Index	Contract Number Index	Subject Index	Personal Author Index	Corporate Author Index